Operationalizing Equity Tiebreaker in San Francisco Student School Assignment

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SFUSD

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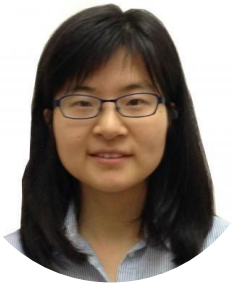


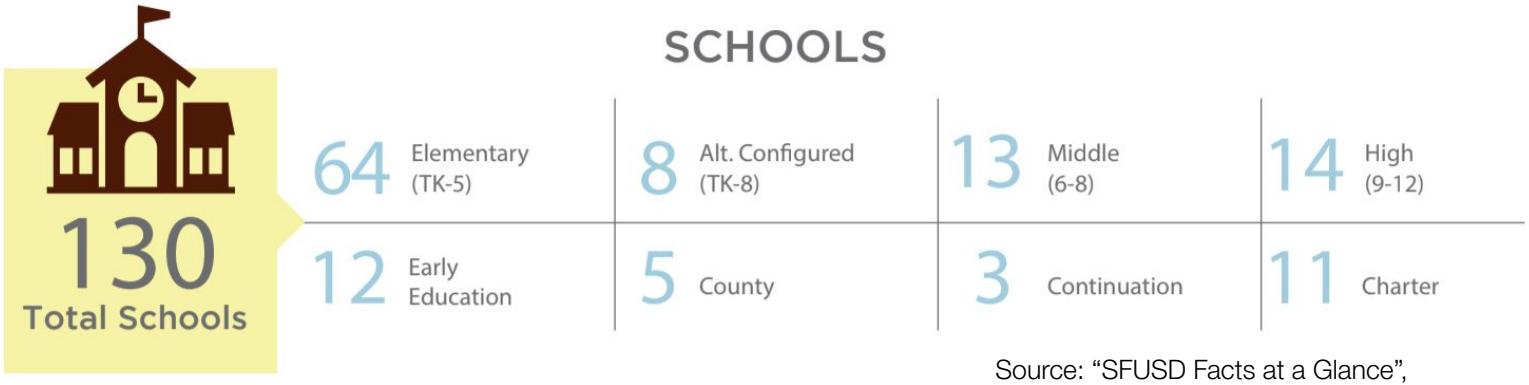
Qian Zhao
technical mentor

Irene Lo
faculty mentor

1. Background

The San Francisco Unified School District

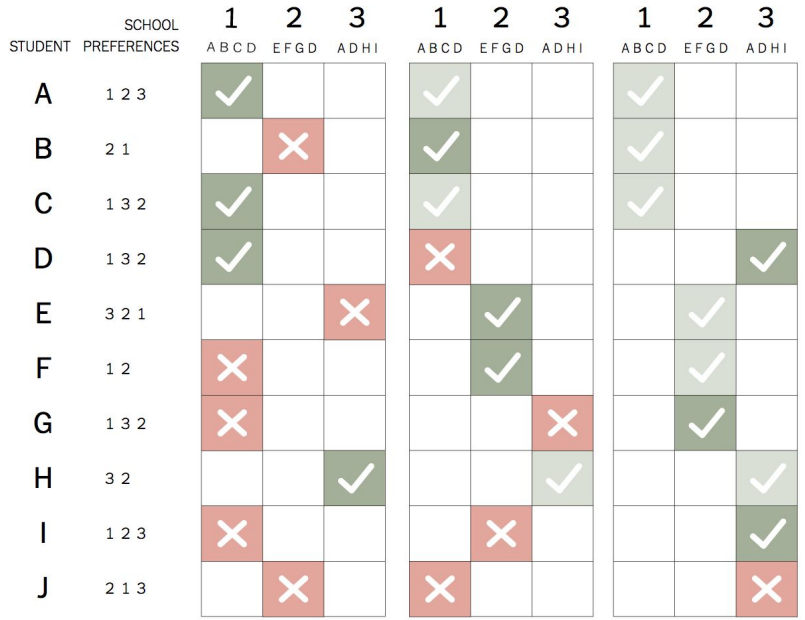
- Very diverse & large district
  - However, many neighborhoods and schools have history of segregation
- Student assignment policies sought to desegregate schools since 1971
- All students should benefit from diversity of SFUSD



Source: “SFUSD Facts at a Glance”, SFUSD Communications

Student Assignment Algorithm

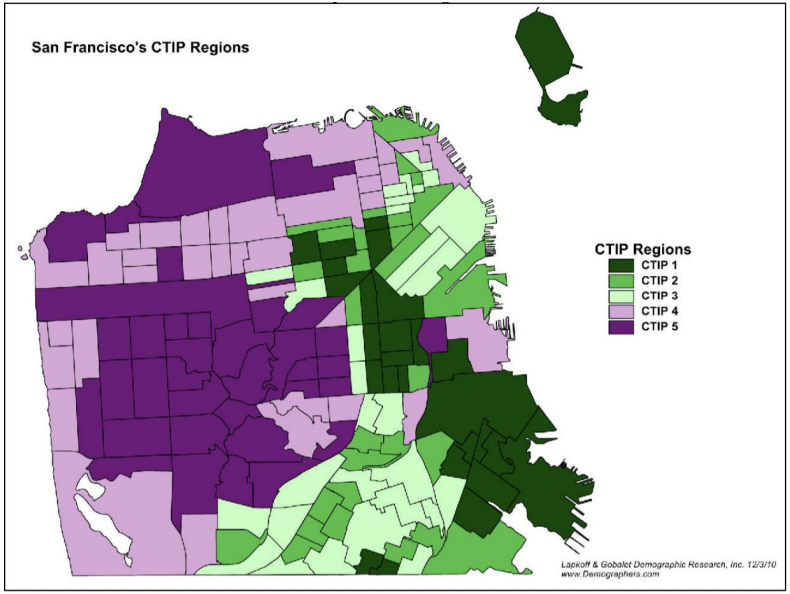
- Students list preferences
- If applicants exceed available seats, **tiebreakers** give preferences to certain applicants
  - Sibling Tiebreaker
  - Pre-K Tiebreaker
  - CTIP1 Tiebreaker
- Lottery breaks remaining ties



Source: “How Game Theory Helped Improve NYC High School Application Process”, New York Times

CTIP1 Tiebreaker (2011-2022)

- Students living in census tracts with lowest average test scores receive tiebreaker
  - 2006-09 CST English Language Arts exam
- Not sufficiently predictable, transparent, or **flexible**
- Choice patterns exacerbate racial & economic segregation



Source: Census Tract Integration Preference (CTIP) Regions: Supporting Analyses, 2010

Proposed Policy

- **Board Resolution (2018)**
  - Develop a community-based student assignment system
  - The goals are to increase diversity, predictability and proximity, and equitable access to education
- **Zone-based Student Assignment Policy (2020)**
  1. Restricts choice to **geographic zones**
  2. Redesigns the CTIP1 tiebreaker as the **equity tiebreaker**
  3. Uses **diversity categories** to reserve seats at each school according to the zone demographic

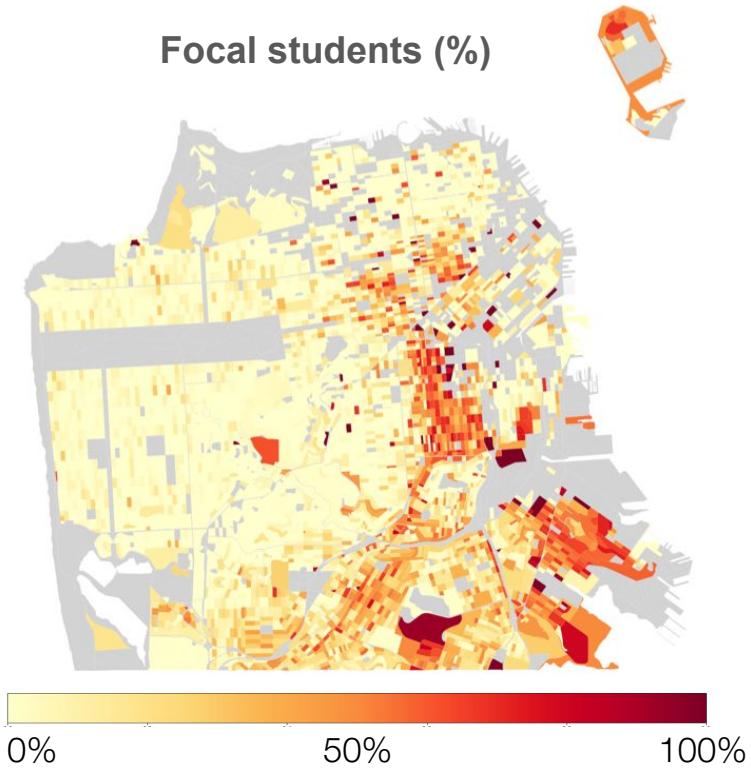
Proposed Policy (2018 Resolution)

1. Restrict choice to **geographic zones**
2. Redesign the CTIP1 tiebreaker as the **equity tiebreaker**
3. Use **diversity categories** to reserve seats at each school according to the zone demographics

Goals: Improve school diversity and equitable access to education

Focal Students

- Students that we would like to attribute the equity tiebreaker are **focal students**
- Current focal students are intersection of two underserved groups & communities:
  1. African American, Latinx, and Pacific Islander (**AALPI**) students
  2. Free or Reduced-Price Lunch (**FRL**) eligible students
- Roughly 24% of the SFUSD
- This definition may be adapted



Project Goals

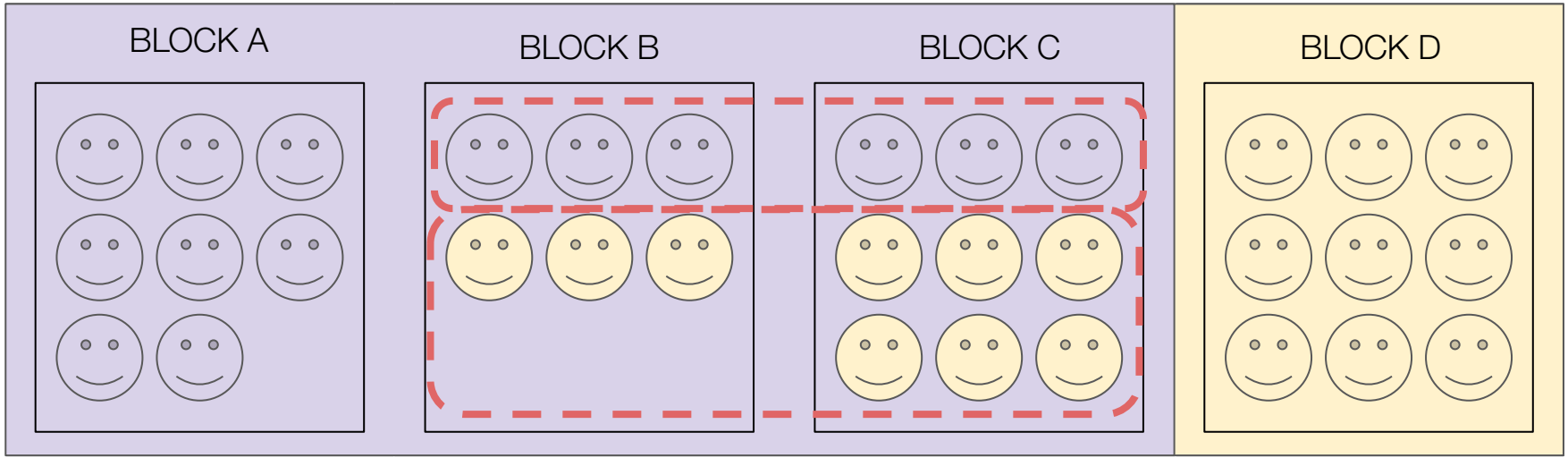
- Design an equity tiebreaker for elementary school assignment
- Improve equity in educational access for focal students
  - Focal students should be assigned to one of their most preferred schools
- Policy should be Interpretable, transparent, and flexible
  - Increase trust between communities/families & SFUSD

"[The equity tiebreaker is] A tiebreaker based on a **student's residence**.
[...]
Individual students' demographic characteristics will not be considered."

2. Methodology

Tiebreaker Trade-offs

false positives: non-focal with tiebreaker



false negatives: focal without tiebreaker

focal students non-focal students

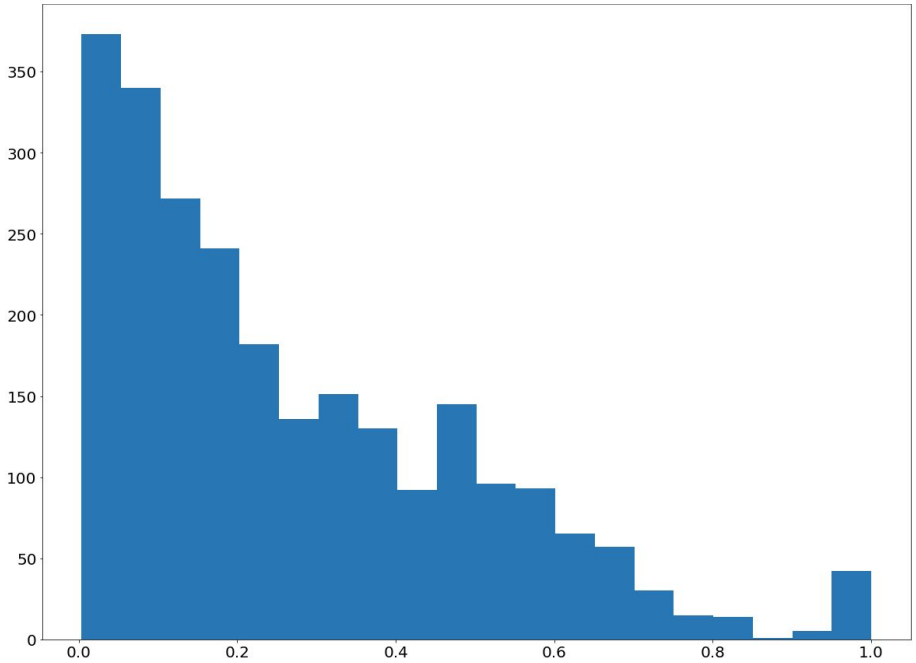
Tiebreaker Trade-offs

Most blocks are **heterogeneous**

The median percentage of focal students (excluding zero) is around

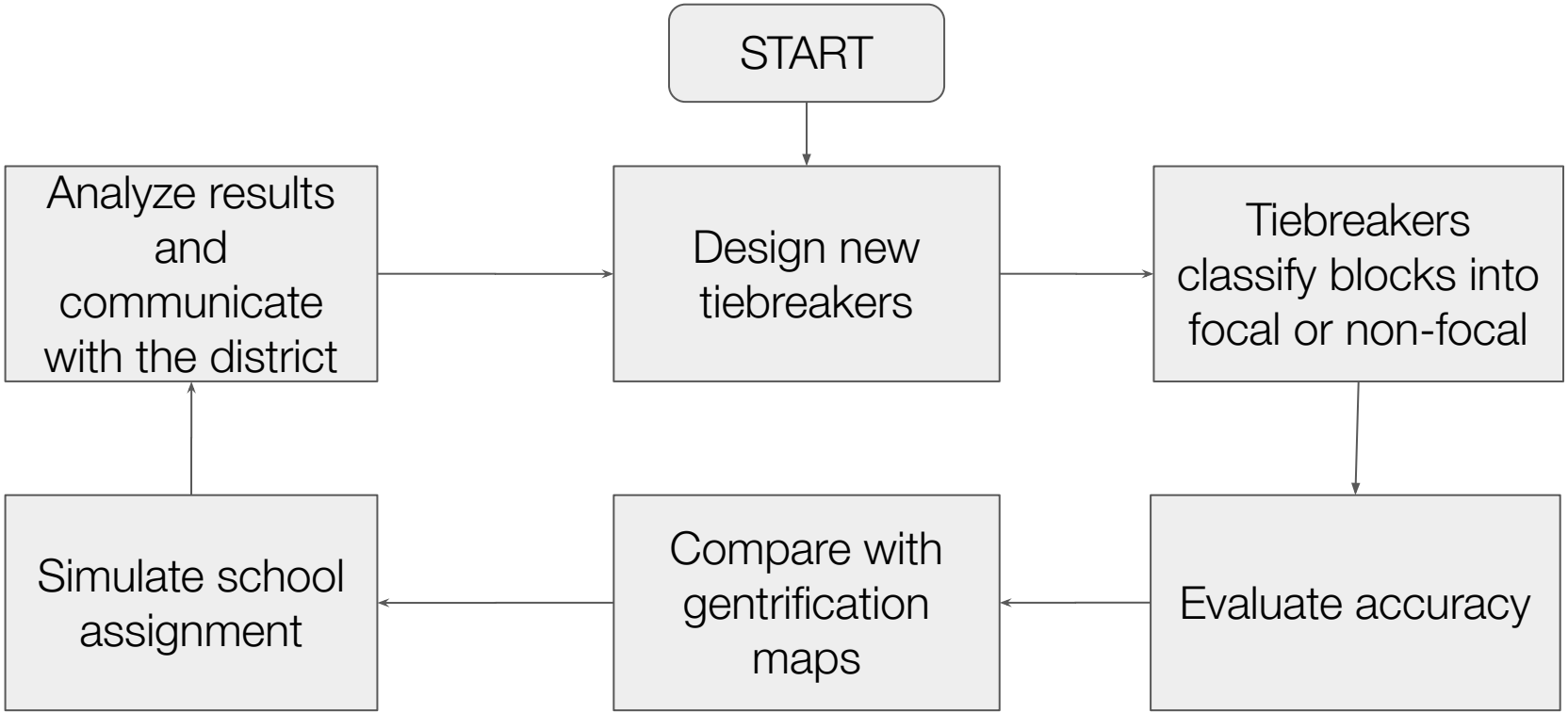
20%

We expect a high trade-off between the false positives and false negatives

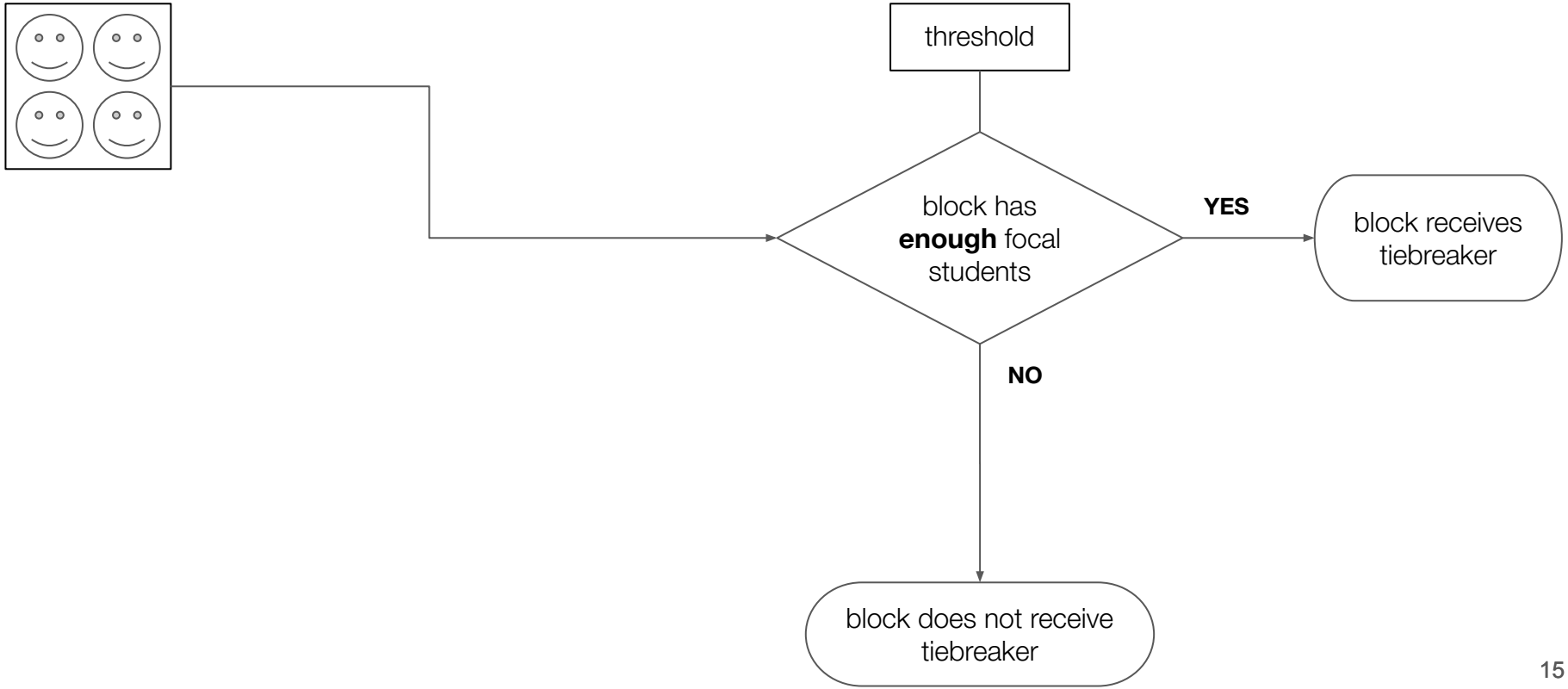


Distribution of non-zero focal student percentages

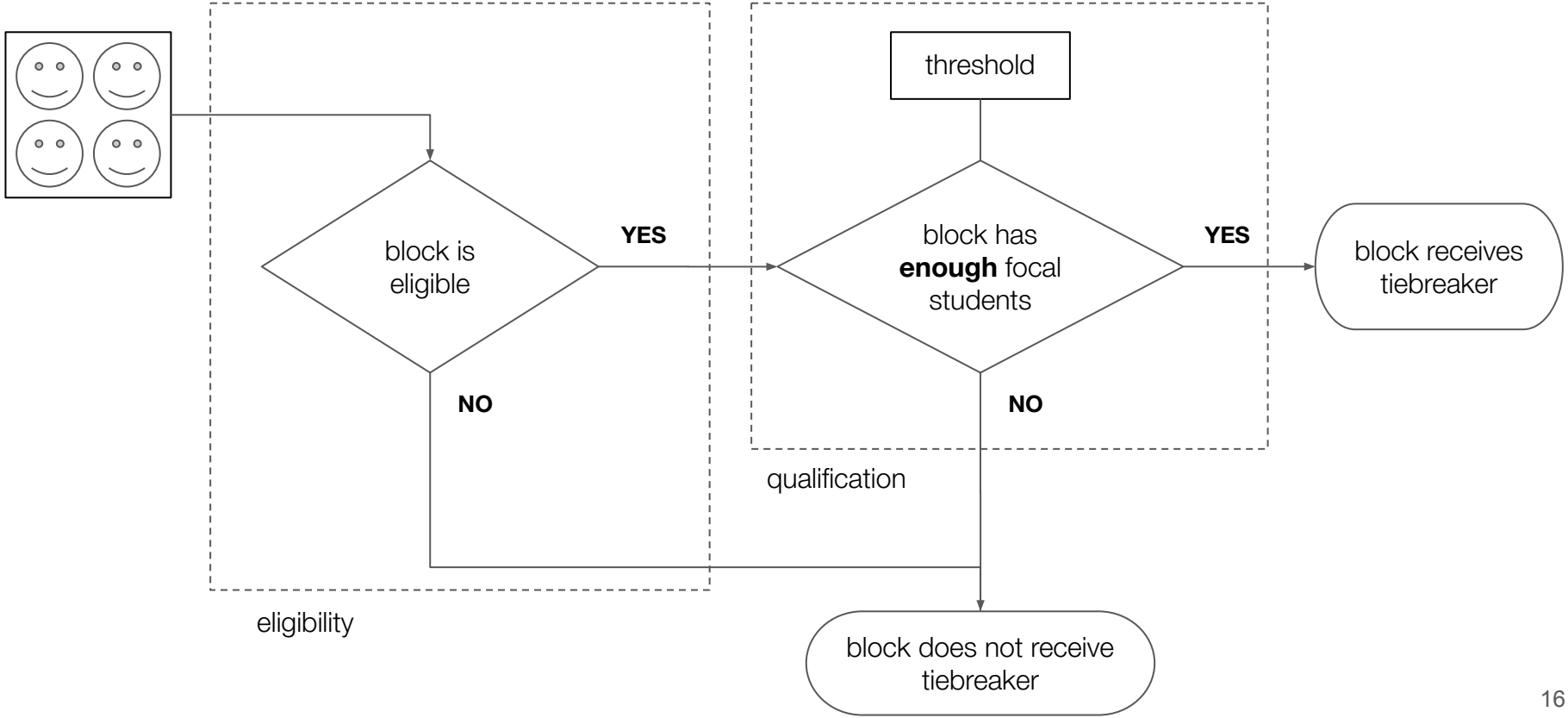
Project Overview



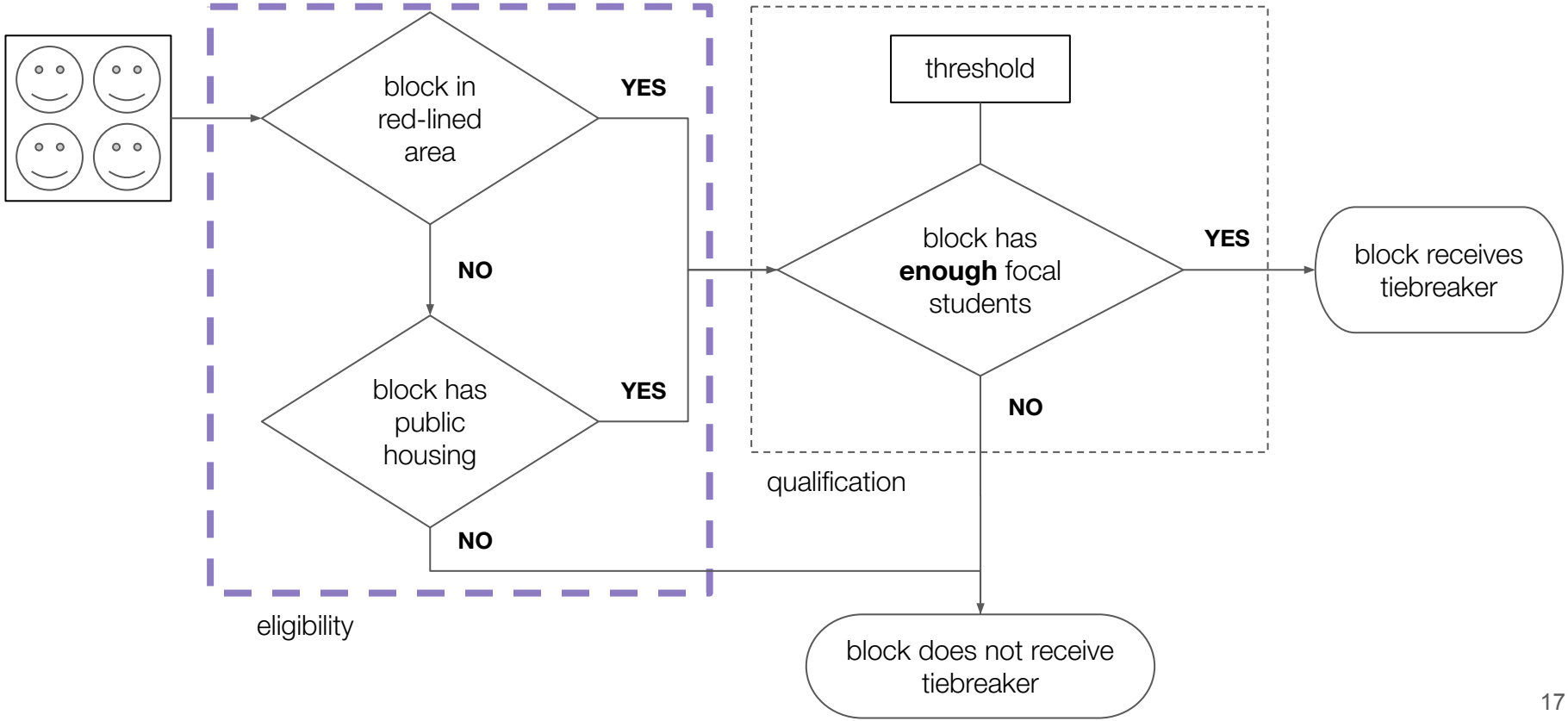
Benchmark tiebreaker



Block Classification Procedure

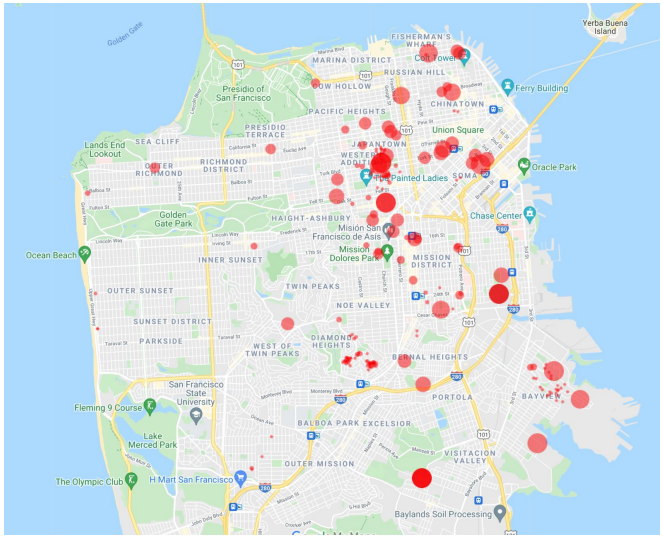


Block Classification Procedure

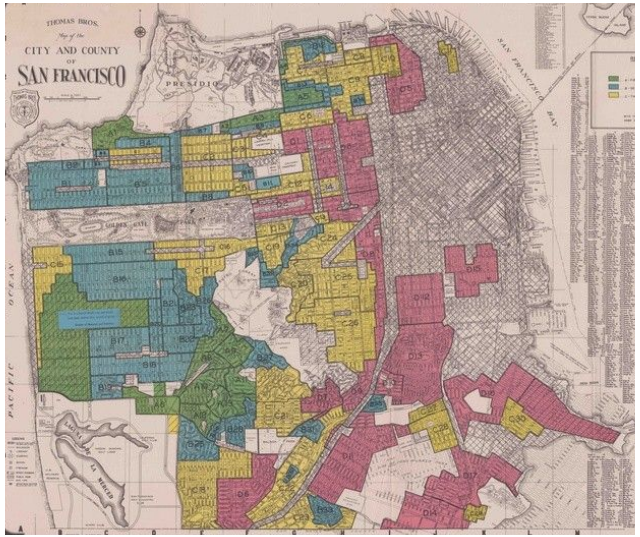


Block Classification Procedure

"The equity tiebreaker will be applied to applicants who either reside in **Federal public housing** or in **historically underserved areas** of San Francisco."



Federal public housing projects in San Francisco

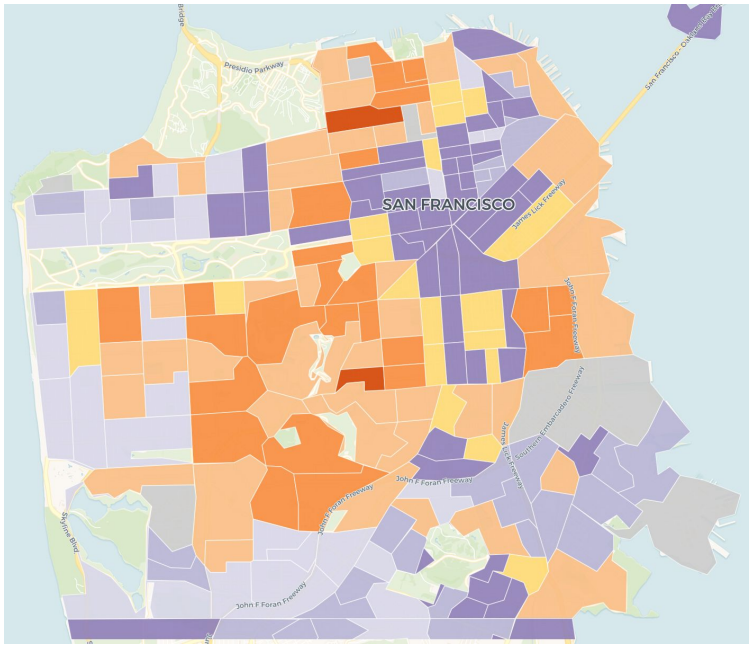


HOLC grades for San Francisco (redline)

Further Considerations

- Alternative eligibility criteria
  - Access to urban amenities
  - School funding
- Qualifying criteria which account for intersectionality
- Gentrification status of the neighborhoods receiving the tiebreaker

Gentrification in San Francisco



Source: Urban Displacement Project , UC Berkeley

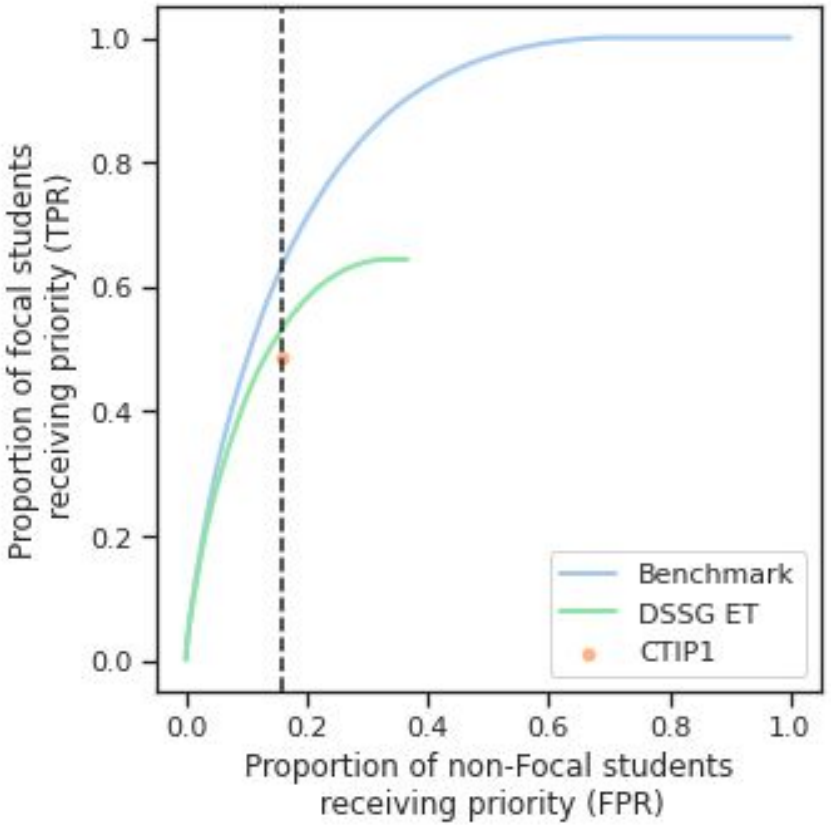
3. Main Results

Simulation set up

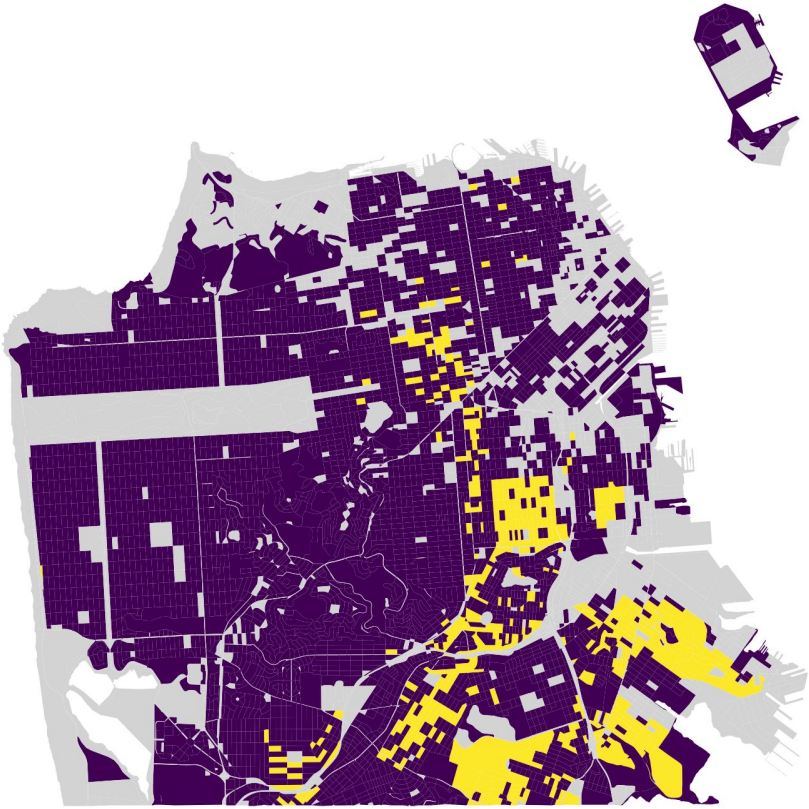
We compare four methodologies:

1. No equity tiebreaker (No ET)
2. CITP1
3. Benchmark Tiebreaker
4. DSSG Equity Tiebreaker (ET)

We use versions of the Benchmark and DSSG ET methodologies with 16% False Positive Rate (black dashed line).

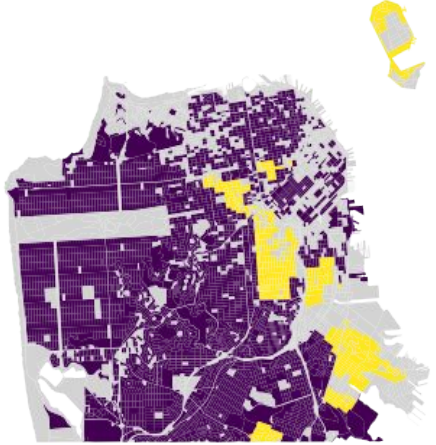


The DSSG Equity Tiebreaker



Benchmark

CTIP1

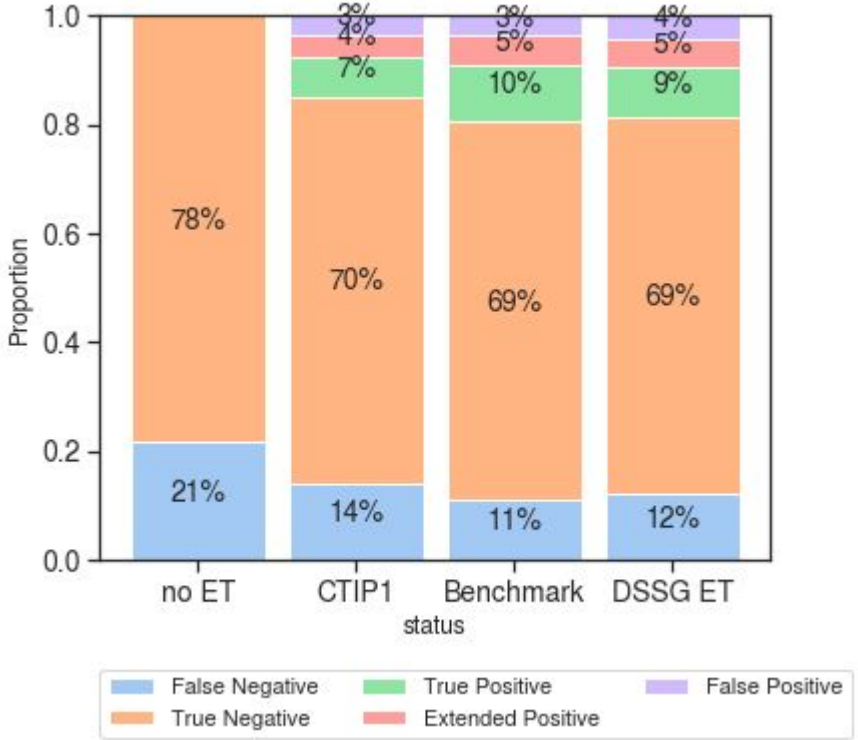


Distribution of students receiving the tiebreaker

Method	False Positive Rate	True Positive Rate
No ET	0	0
CTIP1	10%	34%
DSSG ET	12%	43%
Benchmark	11%	48%

Focal students: **both** AALPI **and** FRL students
Extended focal students: **either** AALPI **or** FRL students

Extended-positives (EP): Extended focal students receiving the tiebreaker

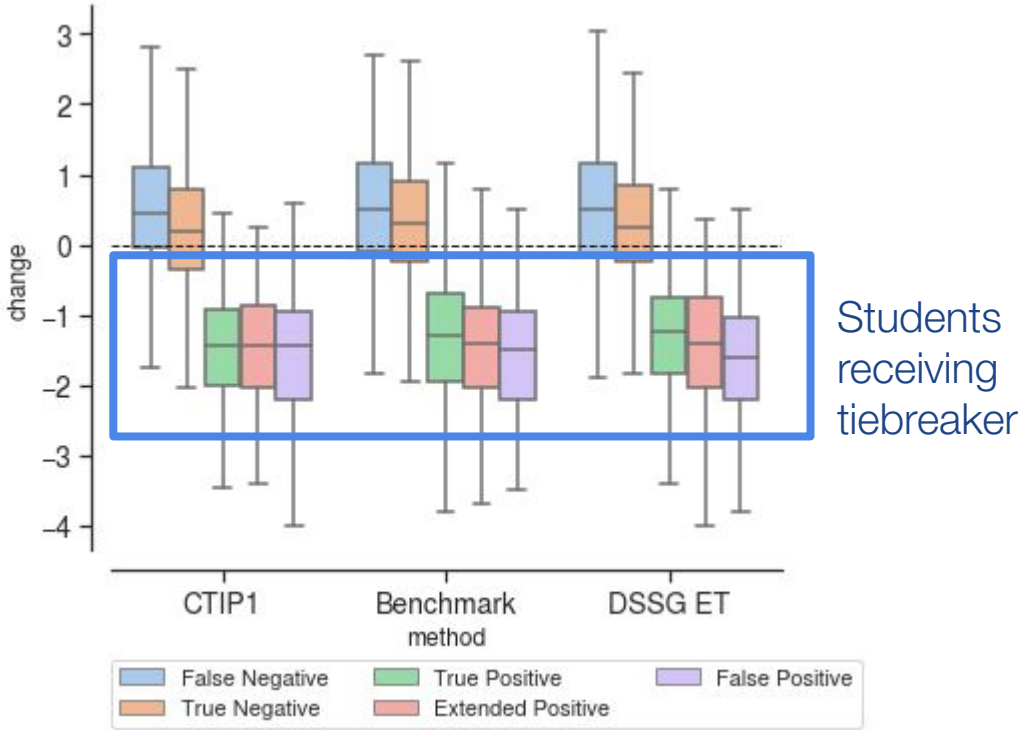


Are students better off by getting the equity tiebreaker?

Worse-ranked program

Average change* in rank of assigned program

Better-ranked program



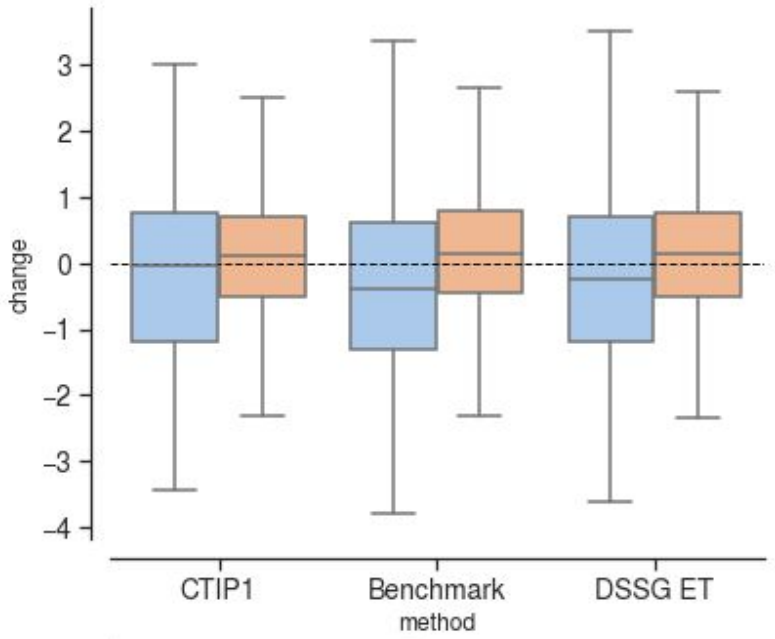
*compared to no equity tiebreaker; results averaged over 20 simulations

Are <u>focal students</u> better off with the equity tiebreaker?

Worse-ranked program

Average change* in rank of assigned program

Better-ranked program



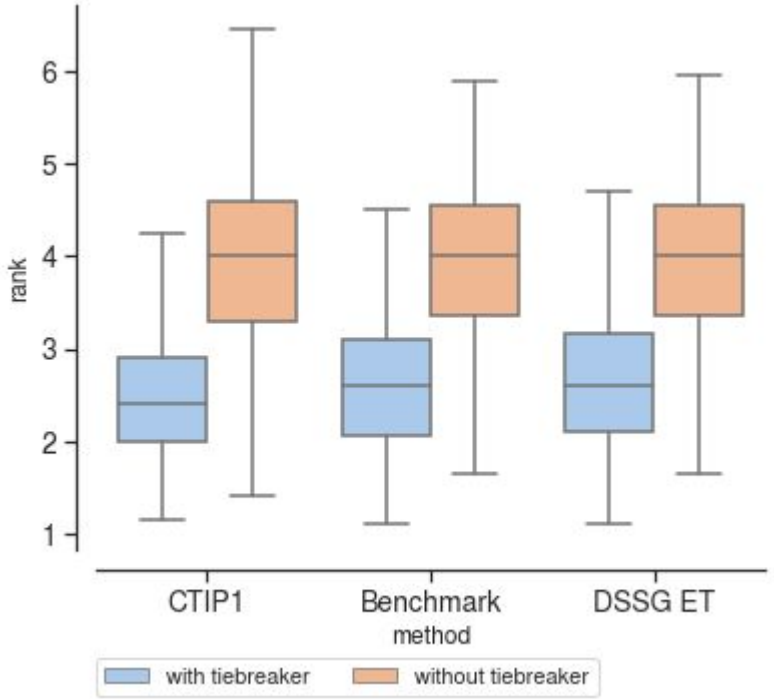
Focal:
True positive +
False Negative

Non-focal:
False positive +
Extended Positive +
True Negative

**compared to no equity tiebreaker; results averaged over 20 simulations*

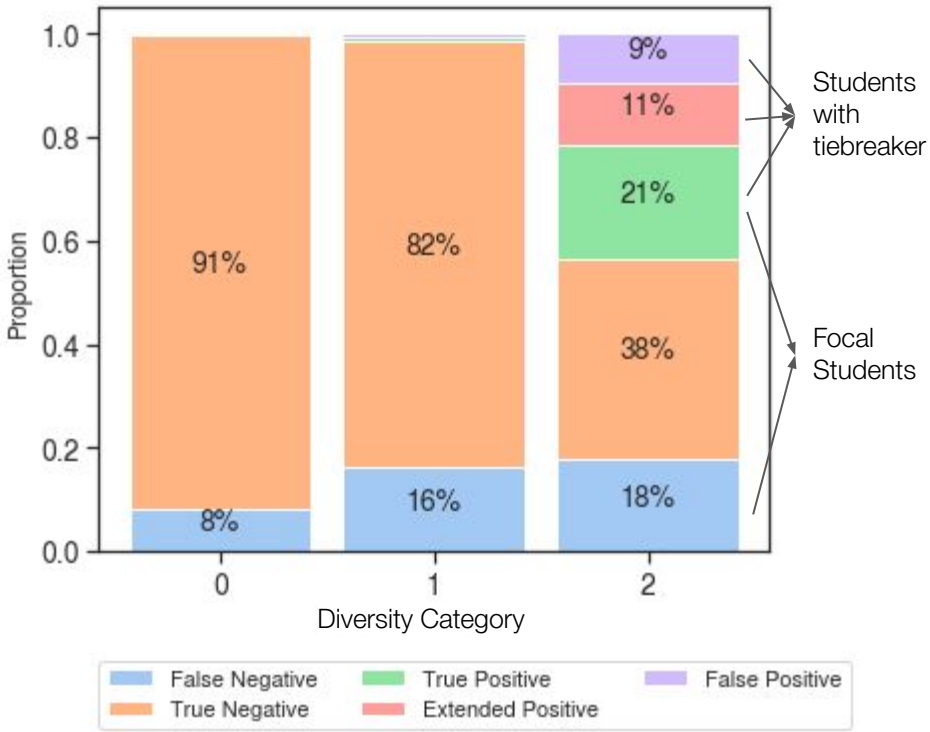
Rank distribution of focal students receiving the tiebreaker

This plot shows the distribution of the average rank of the assigned program of focal students when they receive the equity tiebreaker and when they do not.



Discussion of Results and Limitations

- Our equity tiebreaker improves the focal student's school choice
- The improvement is small on average
  - Students targeted by the tiebreaker all belong to the same **diversity category**
  - The number of focal students is too large



4. Conclusions

Contributions

- We developed an equity tiebreaker that is:
  - **Interpretable** according to the SFUSD policy
  - **Transparent**, yet not gameable
  - **Flexible** to changes in the group of focal students
- Tiebreaker performs well when compared to a benchmark model or to the current (CTIP1) process
  - Focal students receiving tiebreaker see an improvement in their assignment outcome
  - More focal students are reached than under the current process
- We documented our analysis on an interactive notebook
  - SFUSD staff can experiment with new parameters

Future Work

- Defining focal students is an iterative process
  - Better tiebreakers may be possible if a narrower definition of focal students is proposed
- **Community feedback** can be incorporated into the design of the tiebreaker
  - Parental buy-in is important, and the district must communicate the tiebreaker to parents
- **Gentrification** issues could be addressed more coherently
- The tiebreaker must be incorporated into the rest of the assignment process
  - School zone decisions may influence the tiebreaker eligibility process
  - Guardrails limit the “ties” to students of the same diversity category

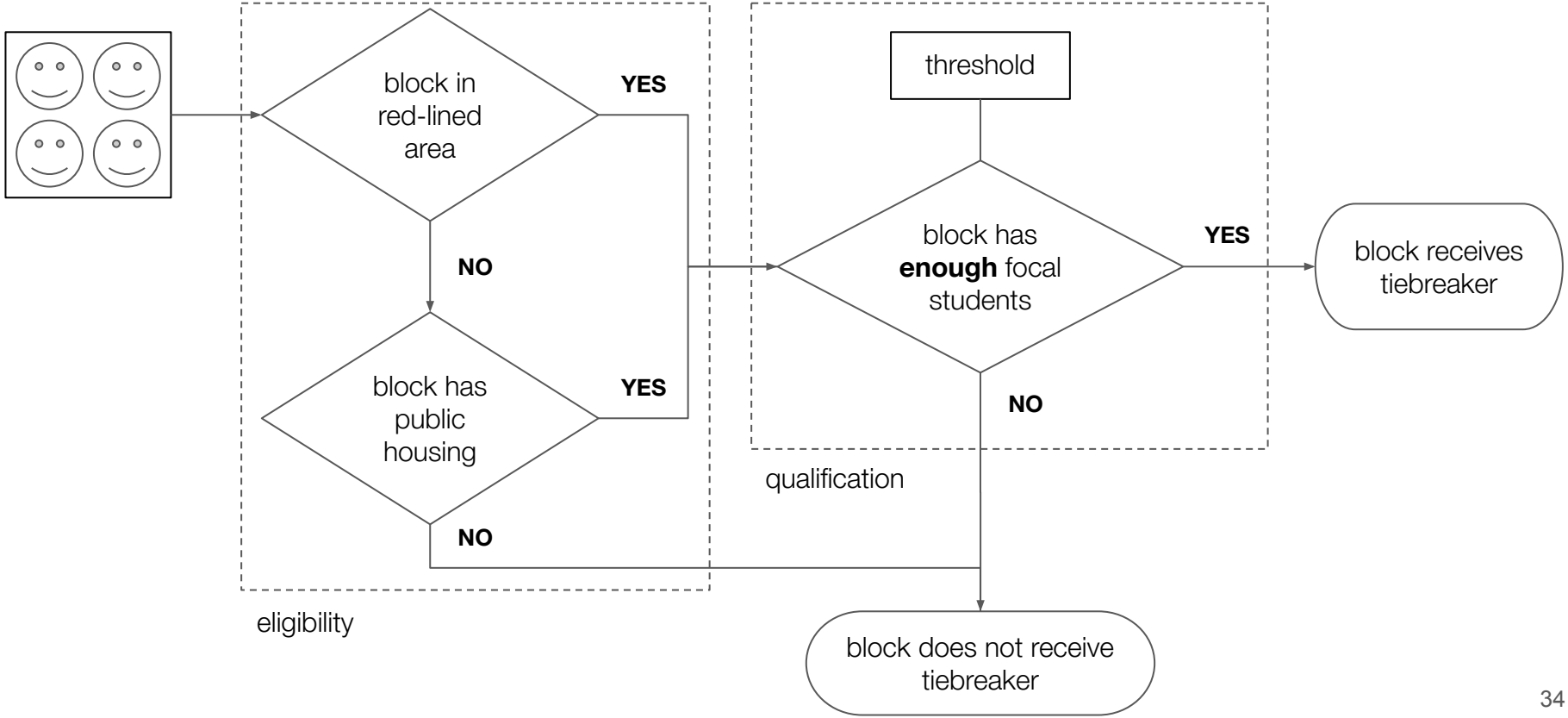
Future Work

- On the SFUSD side:
  - Understand the tiebreaker methodology and **provide feedback** on criteria we used
  - Gather **community** feedback
  - **Redefine focal students** to a narrower group to ensure the tiebreaker targets them
- On the Stanford research team side:
  - Review results once a new definition of focal students is provided
  - Analyze the impact of **zones** and **diversity categories**
- On both sides:
  - Understand **gentrification** impacts and how to cohesively address them

Thank you!

Appendix

Block Classification Procedure



Block Classification Procedure: *other possible criteria*

For the **eligibility criteria**:

1. Access to urban amenities
2. Public transportation routes
3. Median school funding
4. Aggregated neighborhood demographics

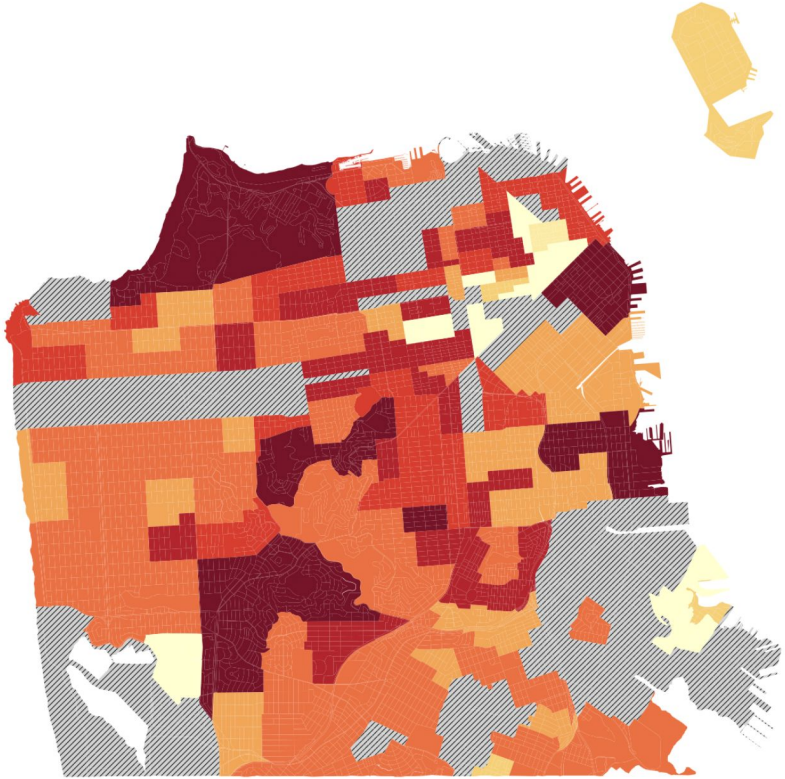
For the **qualifying criteria**:

1. Intersectionality (weighted demographics)

Proportion of students getting 1 of their top 3 choices

Method	Student status	Average proportion	Standard deviation of proportion
No ET	Focal	**57%**	1.1%
	Not Focal	59%	0.7%
CTIP1	Focal	60%	1.1%
	Not Focal	58%	0.8%
DSSG ET	Focal	**62%**	1.3%
	Not Focal	58%	0.9%
Benchmark	Focal	63%	1.5%
	Not Focal	57%	0.7%

Incorporating Gentrification



Stable/Advanced Exclusive

Becoming Exclusive

At Risk of Being Exclusive

Avoid

Stable Moderate/Mixed Income

Advanced Gentrification

Monitor

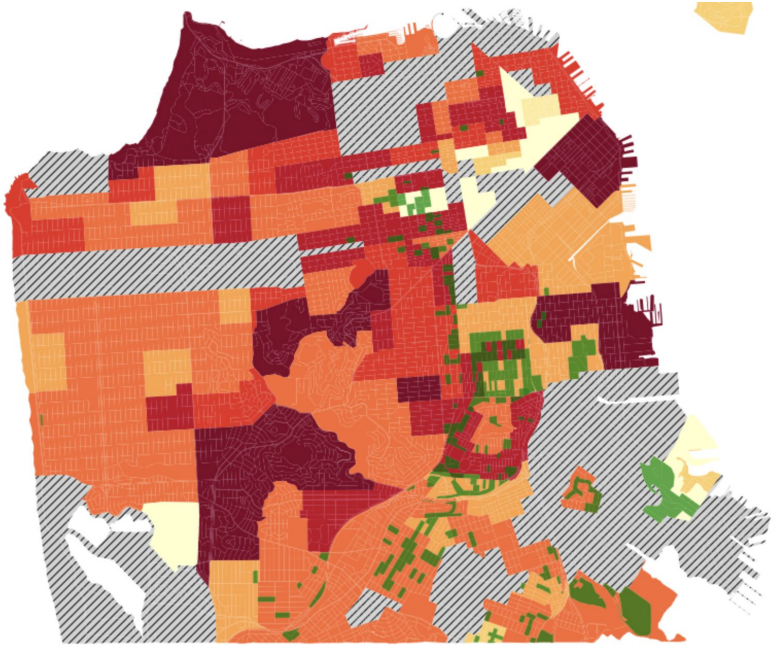
Early/Ongoing Gentrification

At Risk of Gentrification

Ongoing Displacement

Target

Incorporating Gentrification



Stable/Advanced Exclusive

Becoming Exclusive

At Risk of Being Exclusive

Avoid

Stable Moderate/Mixed Income

Advanced Gentrification

Monitor

Early/Ongoing Gentrification

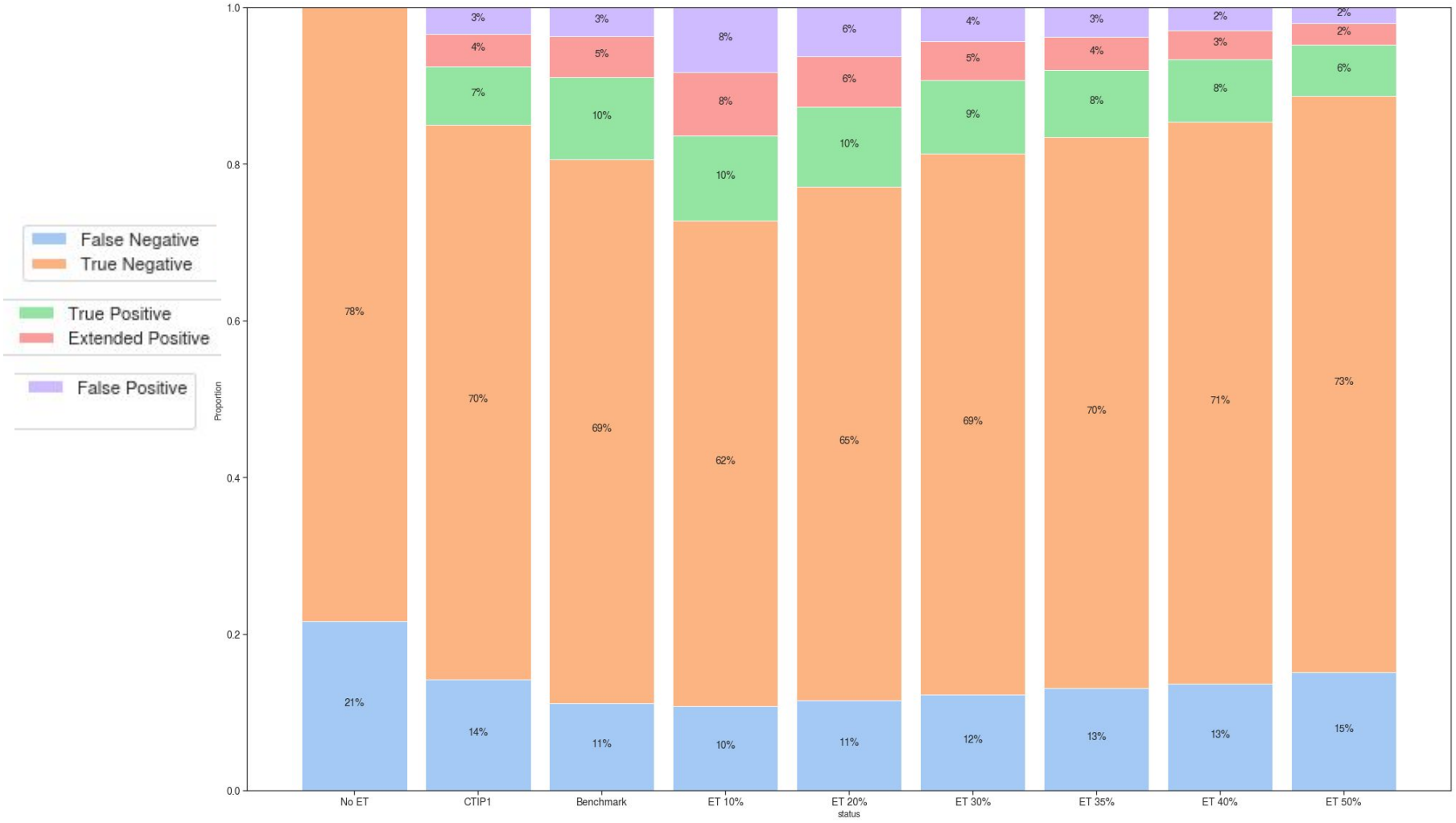
At Risk of Gentrification

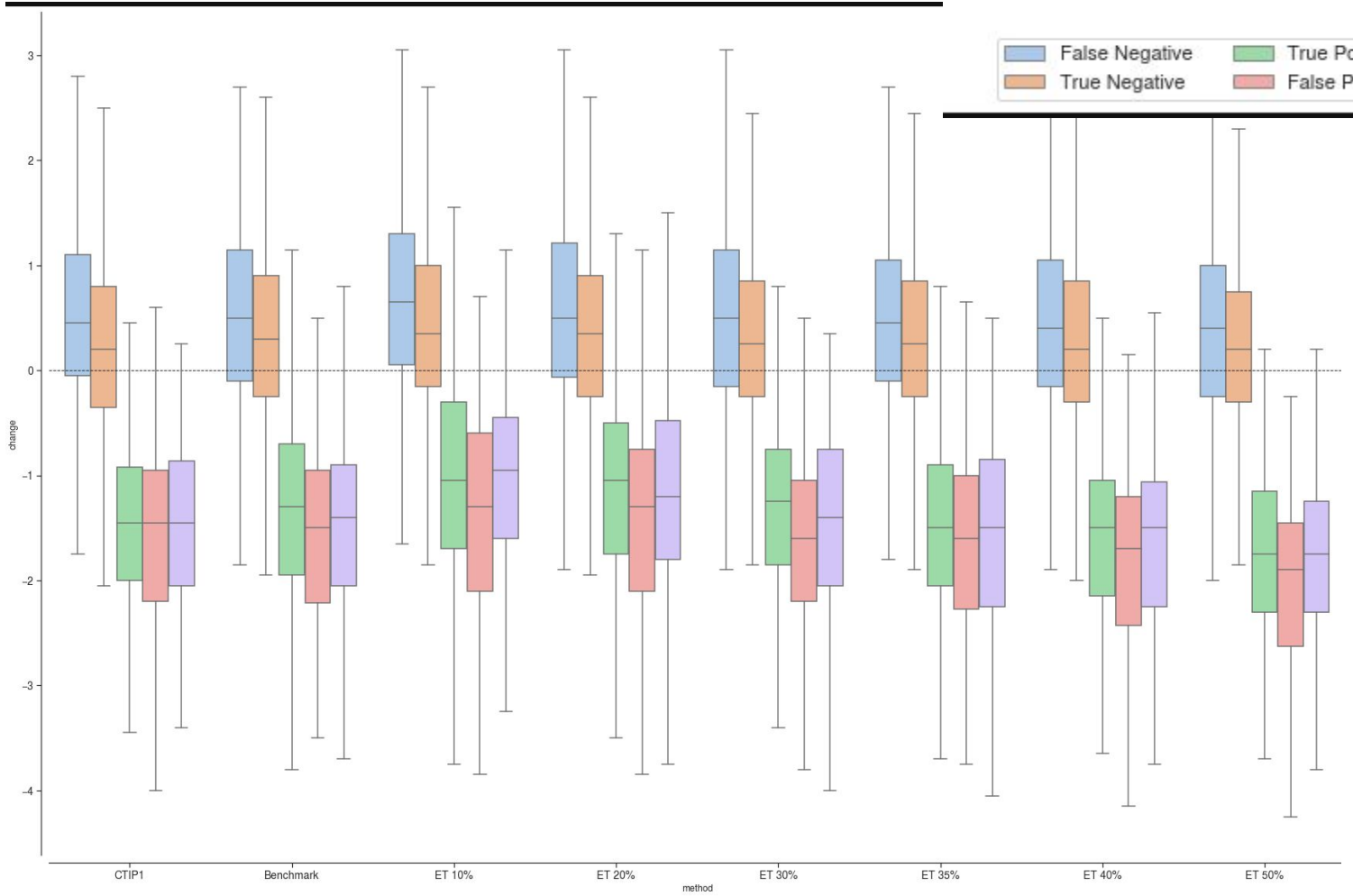
Ongoing Displacement

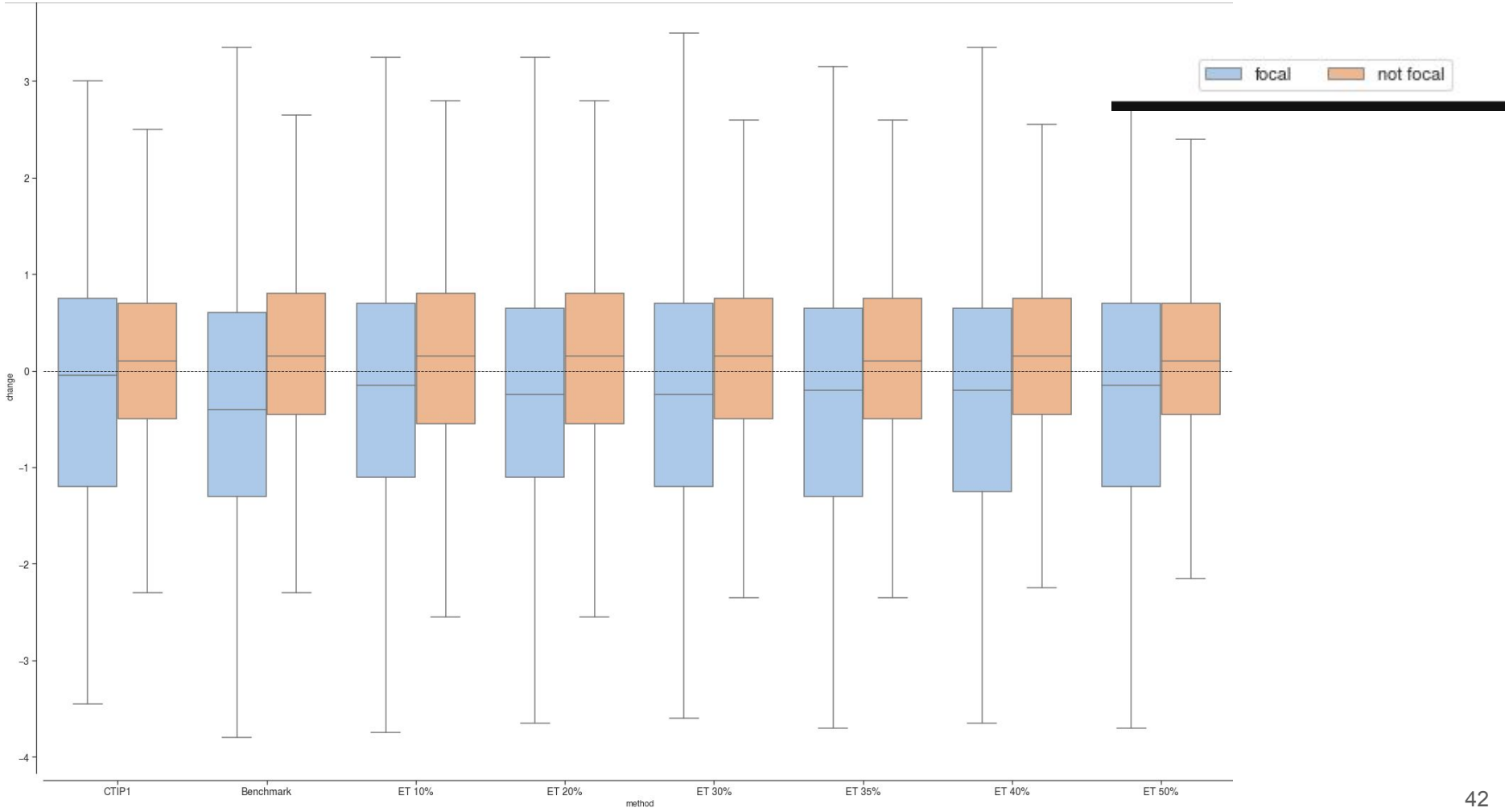
Target

Results for Different Thresholds of the DSSG ET

Focal: AALPI **and** FRL


False Negative
True Negative
True Positive
Extended Positive
False Positive
Proportion
1.0
0.8
0.6
0.4
0.2
0.0
78%
21%
3%
4%
7%
70%
14%
3%
5%
10%
69%
11%
8%
8%
10%
62%
10%
6%
6%
10%
65%
11%
4%
5%
9%
69%
12%
3%
4%
8%
70%
13%
2%
3%
8%
71%
13%
2%
2%
6%
73%
15%
No ET
CTIP1
Benchmark
ET 10%
ET 20%
ET 30%
ET 35%
ET 40%
ET 50%
status


False Negative
True Negative
True Positive
False Positive
Extended Positive
change
3
2
1
0
−1
−2
−3
−4
CTIP1
Benchmark
ET 10%
ET 20%
ET 30%
ET 35%
ET 40%
ET 50%
method


focal
not focal
change
3
2
1
0
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−2
−3
−4
CTIP1
Benchmark
ET 10%
ET 20%
ET 30%
ET 35%
ET 40%
ET 50%
method

Results for No Guardrails vs. Guardrails

[Gabriel] Adding plots here so we can refer to them without running the notebooks

Focal: AALPI **and** FRL

DSSG ET used: eligibility (housing or redline) and threshold = 35%

without guardrails

with guardrails

Change in avg rank for focal group (TP + FN)

		change				
		mean	std	sem	lower_95ci	upper_95ci
method	focal					
DSSG ET	focal	-0.64	1.69	0.05	-0.75	-0.54
	not focal	0.17	1.25	0.02	0.13	0.21

		change				
		mean	std	sem	lower_95ci	upper_95ci
method	focal					
DSSG ET	focal	-0.30	1.30	0.04	-0.37	-0.22
	not focal	0.09	1.05	0.02	0.06	0.13

Change in avg rank

		change				
		mean	std	sem	lower_95ci	upper_95ci
method	status					
DSSG ET	Extended Positive	-2.49	0.83	0.06	-2.60	-2.38
	False Negative	0.56	0.86	0.03	0.49	0.62
	False Positive	-2.62	0.75	0.06	-2.73	-2.51
	True Negative	0.48	0.85	0.01	0.45	0.51
	True Positive	-2.47	0.75	0.04	-2.54	-2.40

		change				
		mean	std	sem	lower_95ci	upper_95ci
method	status					
DSSG ET	Extended Positive	-1.60	0.96	0.07	-1.73	-1.46
	False Negative	0.49	0.90	0.04	0.42	0.56
	False Positive	-1.63	0.88	0.07	-1.76	-1.50
	True Negative	0.29	0.88	0.02	0.26	0.32
	True Positive	-1.49	0.81	0.04	-1.57	-1.41

% of TP students in top 3 choices

		rank				
		mean	std	sem	lower_95ci	upper_95ci
method	focal					
DSSG ET	focal	0.68	0.01	0.0	0.68	0.69
	not focal	0.57	0.01	0.0	0.57	0.58

		rank				
		mean	std	sem	lower_95ci	upper_95ci
method	focal					
DSSG ET	focal	0.62	0.01	0.0	0.61	0.62
	not focal	0.58	0.01	0.0	0.58	0.59