

# paper1

May 5, 2022

## 1 Inequities in Civilian Complaints to the NYPD - Introduction

In June of 2020, ProPublica requested that the New York Police Department make data on any police officer with at least one legitimate allegation against them public (*The NYPD Files*, 2020). As indicated by ProPublica, complaints submitted by civilians against police officers are hardly ever substantiated, a ruling that indicates the alleged conduct actually occurred and violated NYPD rules.

This paper will explore how substantiation rates vary across complainant ethnicity and borough where the alleged conduct took place. It is assumed that whether a complaint is legitimate, and thus should be substantiated, is independent of complainant ethnicity and location of alleged conduct. In other words, the true proportion of legitimate complaints and true base rate of substantiation for a given complaint should be the same across all civilian ethnicities and locations and no ethnicity is more likely to submit false complaints than another. For example, a complaint submitted by a Black complainant should be just as likely to be substantiated as a similar complaint submitted by an Asian complainant. Furthermore, a complaint submitted by someone in Brooklyn should be just as likely to be substantiated as a similar complaint submitted by someone in Manhattan. This assumption emphasizes that the substantiation of a complaint should depend on the allegation itself, not on external circumstances like complainant ethnicity or location.

Two methods were used to investigate whether this assumption actually holds. Firstly, in comparing substantiation rates for complaints submitted by Black civilians versus non-Black civilians, it was found that Black civilians' complaints are substantiated 2% less often overall and up to 8.5% less of the time (specifically for allegations of Offensive Language). This discrepancy in substantiation rates was found to be statistically significant and violates demographic parity of complainant ethnicity. Secondly, substantiation rates were compared for boroughs that have similar levels of police presence. Despite having similar levels of police presence, as measured by average number of arrests made per year, complaints occurring in Brooklyn were less likely to be substantiated than those occurring in Manhattan, violating demographic parity by nearly 5%. Given that demographic parity is the only measure of fairness that can be calculated from this dataset, this paper will also discuss how other measures of fairness could theoretically apply to this potential inequity.

All in all, the violations of demographic parity suggest that the assumptions of the true underlying base rates of substantiation are incorrect in reality. This means that the merit of a civilian's complaint could depend on other variables like their ethnicity or where the alleged interaction took place. Ideally, a civilian's complaint should be reviewed on aspects directly related to the complaint. While there are limitations of the dataset provided and analysis performed, it seems that the CCRB is another portion of the law enforcement and criminal justice systems that is biased and unfair.

## 2 Description of Inequity and Context: A Brief History of Policing in the United States

The first iterations of policing in the United States came in the form of slave patrols, which enforced oppressive slave codes and caught runaways. In the mid-1800s, urban cities started forming police departments uncoincidentally following the rise of the abolition movement. Outside of urban areas, where there were no formal police organizations, vigilantes would lynch hundreds of minorities. In early twentieth century Berkeley, California, Army veteran August Vollmer started modern American policing as something heavily influenced by his military experience in oppressing colonized peoples. Across the country, other military veterans became leaders of police departments, and police officers began enforcing Jim Crow laws instead of slave codes, disproportionately arresting Black people in the process (Lepore, 2020).

Today, there exists an inequality in both how police officers treat people of different races and in the quality of police services different communities receive. In poorer, often minority-dominant communities, policing is focused on “intervening in violence,” meaning officers more frequently conduct aggressive investigatory stops (Smyton, 2020). In contrast, more affluent, often predominantly White neighborhoods, see policing that is more service oriented, where officers collaborate with residents to problem solve (Smyton, 2020). In Chicago, residents of the Grand Crossing neighborhood, most of which are minorities, waited nearly 4.5 times longer for major emergency 9-1-1 calls than the mostly White residents of Jefferson Park (*Newly-released data shows City continues to deny equitable police*, 2017). Race continues to influence how Americans are policed.

### 2.1 The Potential Inequity

Based on the data, complaints from Black complainants were less often substantiated (the alleged conduct was found to have happened and violated NYPD rules) than complaints from non-Black complainants. This disparity is seen when examining the complaints by category as well. For all categories except Abuse of Authority (where both groups see similar rates), complaints submitted by Black people were less often substantiated. Most notably, for the “Offensive Language” category, complaints submitted by Black people were substantiated 8.5% less of the time. Considering the history of racial slurs against Black people, this seems especially alarming. In fact, the African American Registry lists “[n-word] stick,” meaning police baton, as one of the slur’s uses (Middleton & Pilgrim, 2022). Last year, it was alleged that a now retired NYPD officer frequently used the n-word and enjoyed pulling his gun on Black people while using the slur (Li & Dienst, 2021).

Substantiation Rates for Black vs. non-Black Complainants

	substantiated
black	
False	0.259498
True	0.238084

Substantiation Rates for Black vs. non-Black Complainants by Type of Allegation

		substantiated
fado_type	black	
Abuse of Authority	False	0.301879
	True	0.306436

Discourtesy	False	0.248128
	True	0.189238
Force	False	0.129357
	True	0.099849
Offensive Language	False	0.214815
	True	0.129870

#### Difference In Substantiation Rate Between Black and non-Black Complainants

	fado_type	substantiated
1	Abuse of Authority	0.004557
3	Discourtesy	-0.058890
5	Force	-0.029508
7	Offensive Language	-0.084945

## 2.2 The Potential Inequity in terms of Theories of Distributive Justice

Fair Equality of Opportunity requires that everyone, despite their place in society, should have the same prospects of success (Fraenkel, 2020). In this case, “place in society” could be thought of as a complainant’s ethnicity or the borough in which they live, and “prospects of success” would refer to the chances of being substantiated. Additionally, since it’s assumed that no group (e.g., ethnicity) of complainant is more likely to submit a false complaint, it is also assumed that all complainants are equally qualified for substantiation. To ensure equality of chance of being substantiated, the CCRB should investigate each complaint equally. In doing so, substantiation rates should be equal and independent of the complainant’s ethnicity or borough. However, based on the discrepancy in substantiation rates for Black complainants and non-Black complainants, this does not seem to be the case.

Under luck egalitarianism, the distribution of the benefit in question, substantiation, should be equal for those with similar circumstances (Fraenkel, 2020). All complainants who submit similar complaints endured similar circumstances and thus should see similar substantiation rates. However, the complainants are likely not on a level playing field. Based on the racial disparities in policing described above, Black complainants could be at a disadvantage in this situation. In fact, reports show that Black New Yorkers are stopped by the police at twice the rate of the average New Yorker (Feuer, 2020). Given the different circumstances Black and White New Yorkers face in police interaction, luck egalitarianism would assume that complaints submitted by Black complainants are more often substantiated. This, however, is not the case as well. Since it is assumed that the true underlying base rates of substantiation should not differ across complainants, luck egalitarianism may not be the correct framework of distributive justice to apply. Nonetheless, neither luck egalitarianism nor Fair Equality of Opportunity seem to be upheld.

## 3 Description of the Data - Measurement and Power

The data observed consists of 31,686 unique complaints to the New York Police Department submitted by 11,312 complainants for the Civilian Complaint Review Board’s review from January 2000 to January 2020. Each complaint comes with information regarding the complainant’s demographics, the police officer’s information and demographics, the nature of the complaint and the alleged action in question, and whether the CCRB deemed the allegation as substantiated (the alleged

action happened and violated NYPD rules). Each complaint in the dataset was investigated by the CCRB, involving a sworn statement from the complainants. Complaints regarding allegations for which investigators were unable to come to a conclusion for are excluded from this dataset.

#### Sample Rows of Complaints Dataset

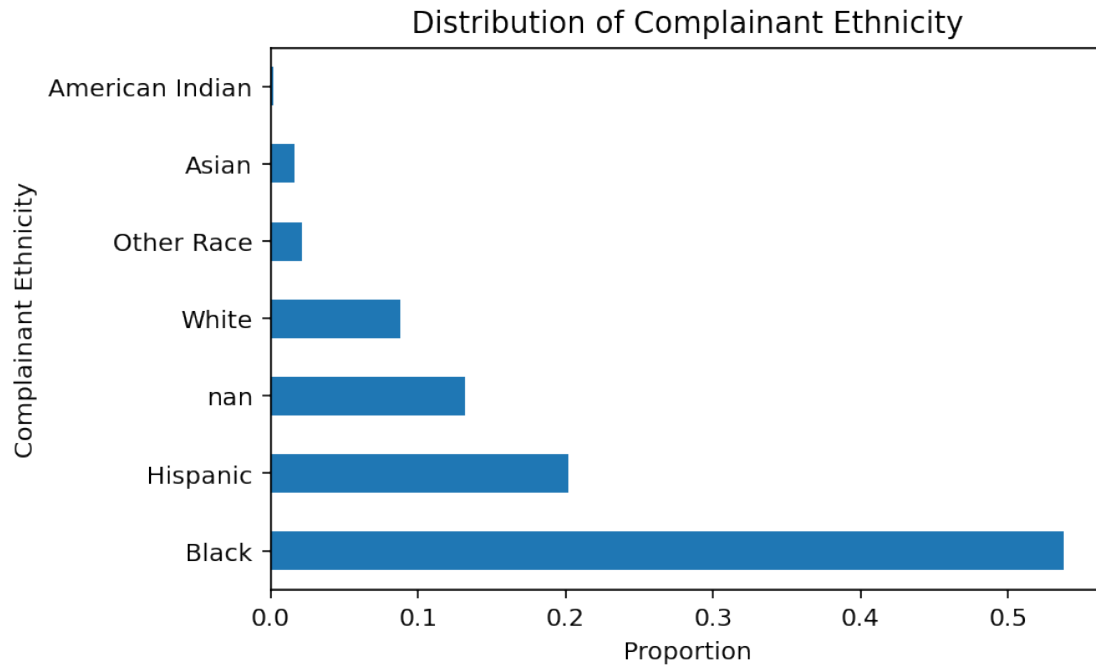
	13769	5283
complaint_id	37797	14639
year_received	2017	2007
complainant_ethnicity	Black	Black
complainant_gender	Female	Male
mos_ethnicity	Asian	Hispanic
mos_gender	M	M
precinct	73	-1
fado_type	Abuse of Authority	Discourtesy
allegation	Refusal to show search warrant	Word
board_disposition	Unsubstantiated	Substantiated (Charges)

The demographics of the complainants are appropriate for investigating whether complaints submitted by Black people are less often substantiated than complaints submitted by non-Black people. The features on the nature of each complaint allow this potential inequity to be investigated conditioned on the type of allegation.

#### Distribution of Complainant Ethnicity

Black	0.538
Hispanic	0.202
NaN	0.132
White	0.088
Other Race	0.021
Asian	0.017
American Indian	0.002

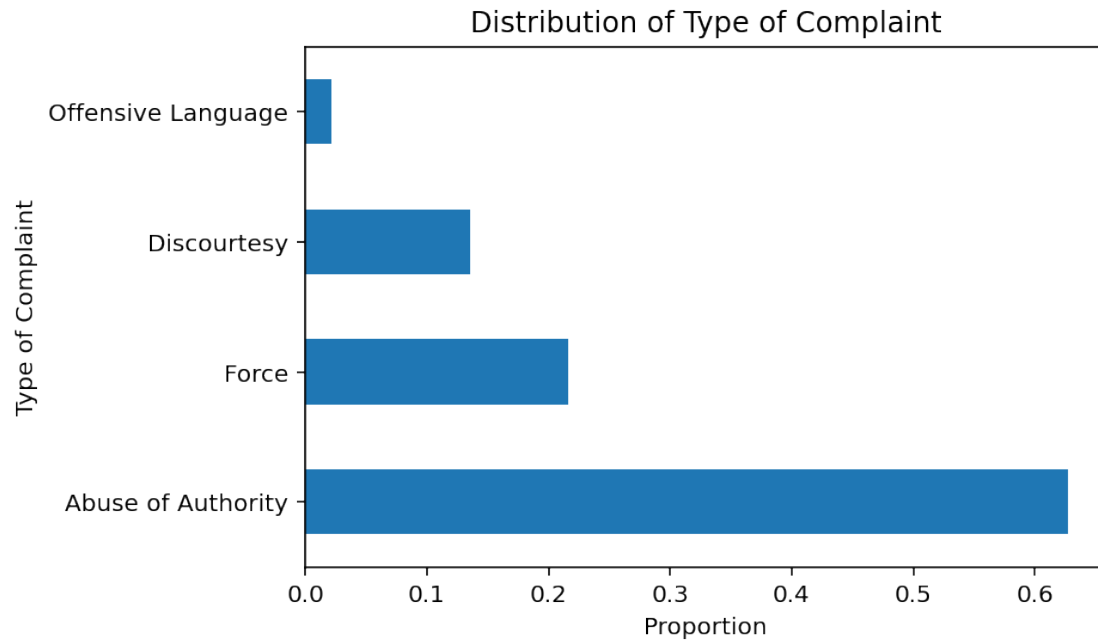
Name: complainant\_ethnicity, dtype: float64



### Distribution of Type of Complaint/Allegation

Abuse of Authority	0.63
Force	0.22
Discourtesy	0.14
Offensive Language	0.02

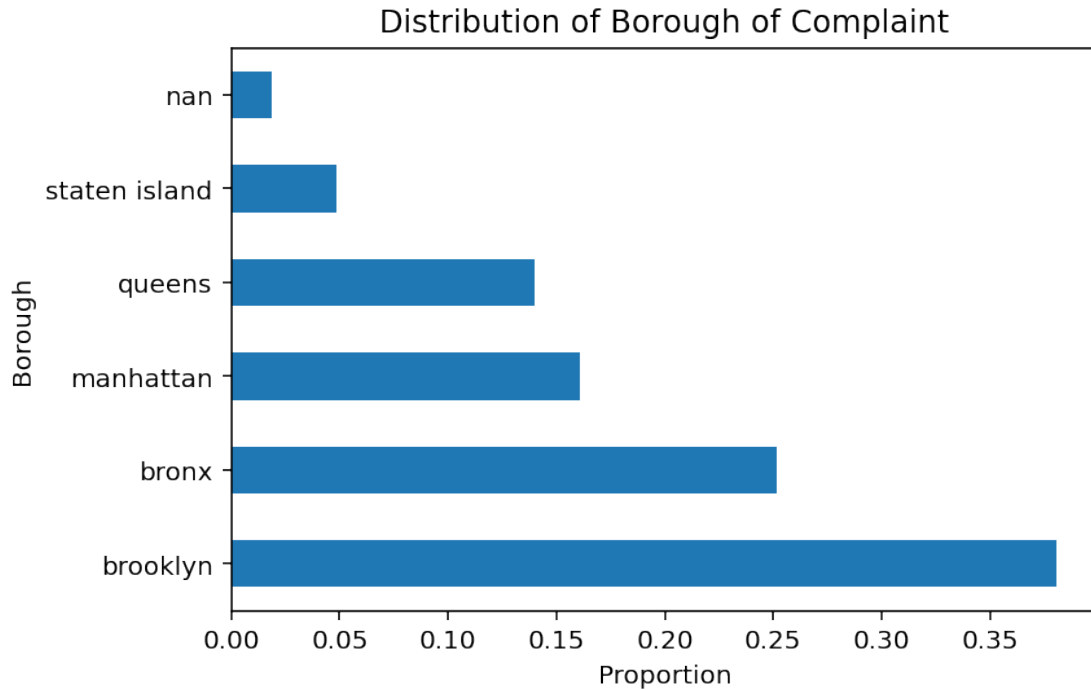
Name: fado\_type, dtype: float64



While borough is not an attribute originally included in the dataset, the NYPD lists each precinct by borough ([Precincts - NYPD, 2022](#)). Thus, using the precinct attribute available in the complaints dataset, the borough of each complaint can be added.

#### Disstribution of Borough of Complaint

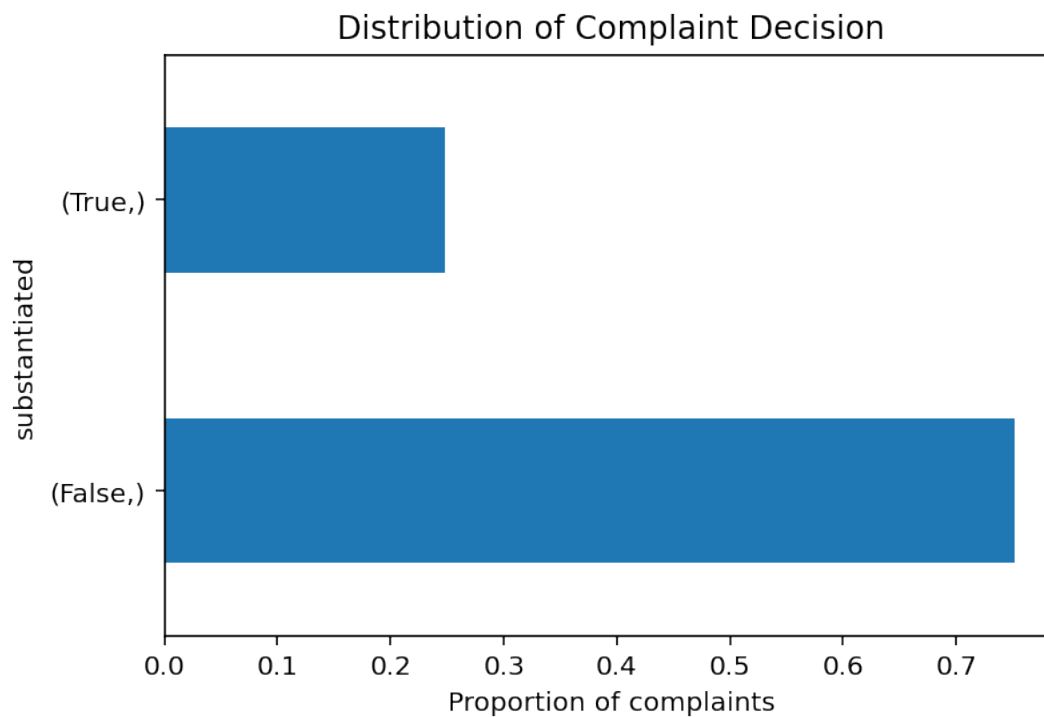
```
brooklyn      0.38
bronx         0.25
manhattan     0.16
queens        0.14
staten island 0.05
NaN           0.02
Name: borough, dtype: float64
```



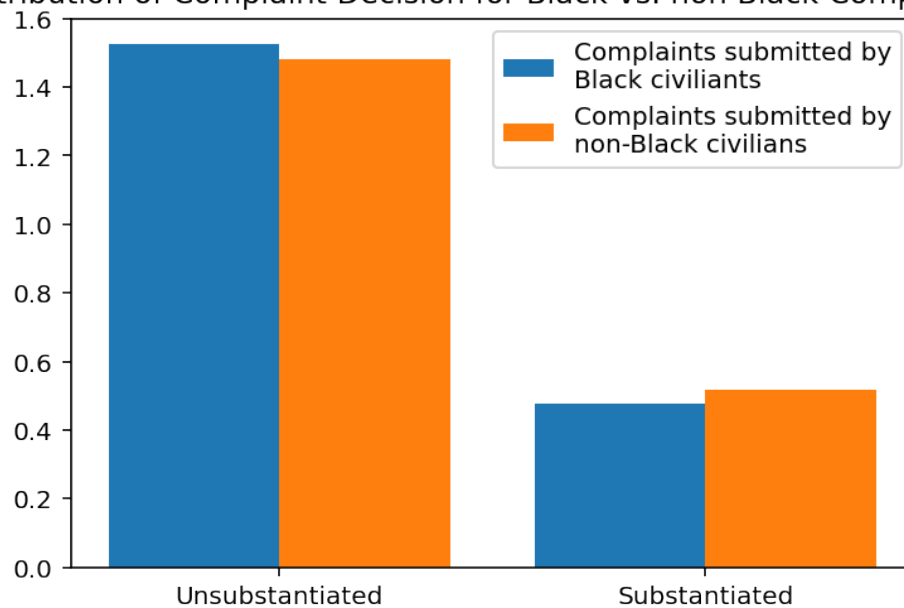
Some shortcomings of the data include the lack of diversity in the ethnicity related variables. The only options are Black, Hispanic, White, Asian, and American Indian. If Afro-Latinx people are recorded as being only Hispanic, this may skew the data. For instance, the ruling of an Afro-Latinx person's complaint may have been biased by the fact that this complainant is Black, but encoding this complainant as only Hispanic could take away from this. Ethnicity being a poorly defined variable could have altered any inequities the data shows.

Another shortcoming of the data is its class imbalance and the omission of complaints that investigators could not draw a conclusion from. As seen above, Black complainants make up the majority of complainants. Additionally, around 10% of rows have no listed ethnicity. Since the data reflects the complaints the CCRB receives, resulting classifiers or analysis may be affected by this imbalance. The small size of the substantiated class is another shortcoming of the data. Since the CCRB hardly substantiates complaints, it is more difficult to identify through data what separates a substantiated complaint from one that is not.

Furthermore, the context in which this dataset was provided is revealing of shortcomings of the data itself and the system from which it originates. Only after ProPublica requested the CCRB to release this data was it provided to the public, leaving the civilians to analyze the data. As an institution of power, the NYPD, CCRB and related government bodies have the resources to analyze this data and audit the quality of their services, yet it seems that they have failed to do so. The NYPD and CCRB, who are responsible for the complaints and the decisions of each complaint, should be the ones to leverage this data to improve their services. However, after civilians have likely noticed no improvement in service, the data was provided to the public, shifting this burden of auditing these institutions of service to the civilians themselves.



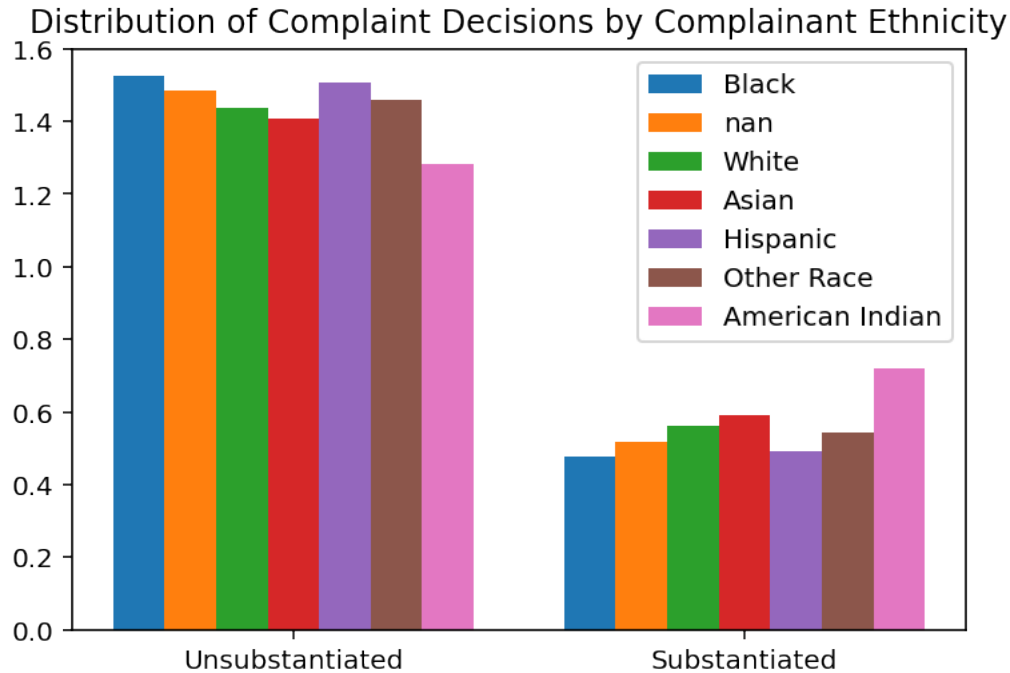
Distribution of Complaint Decision for Black vs. non-Black Complainants



Proportion of Substantiated Complaints and Not Substantiated Complaints for Black vs. non-Black Complainants



substantiated	Substantiated	Not Substantiated
black		
True	0.238084	0.761916
False	0.259498	0.740502



Proportion of Substantiated and Not Substantiated Complaints by Complainant Ethnicity

substantiated	Substantiated	Not Substantiated
complainant_ethnicity		
Black	0.238084	0.761916
Hispanic	0.245993	0.754007
Other Race	0.271212	0.728788
White	0.280683	0.719317
Asian	0.295585	0.704415
American Indian	0.359375	0.640625

### 3.1 Additional Datasets Incorporated for Analysis

To investigate substantiation rates in relation to police presence, two additional datasets were incorporated – data on arrests and data on stops. The arrests dataset contains every arrest from 2006 to 2020 in New York City (*NYPD Arrests Data (Historic)*, 2021). The stops dataset contains every stop made from 2003 to 2020 in New York City (*The Stop, Question and Frisk Data*, 2018). Both datasets will only be used to find the average number of stops/arrests per year per borough. Presumably, a borough with a high number of average number of stops/arrests per year has a high

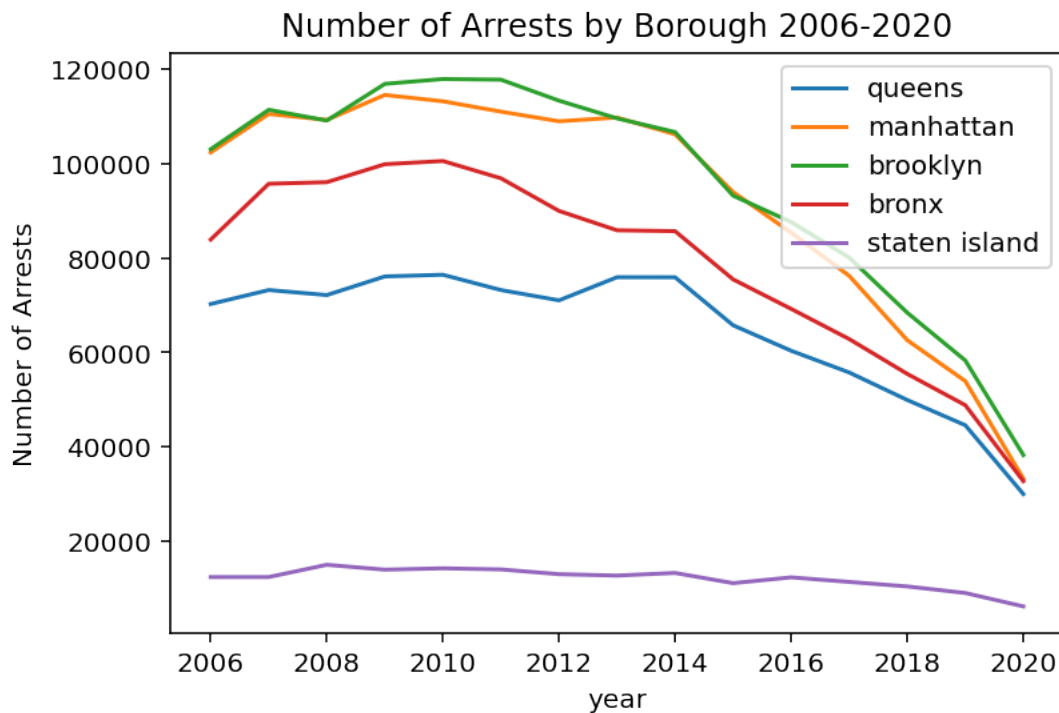
level of police presence, and a borough with a low number has a lower level of police presence. The graphs below show that Brooklyn and Manhattan have similar arrest numbers, as well as the Bronx and Queens. For the stops data, Manhattan, the Bronx, and Queens have similar values, while Brooklyn and Staten Island are outliers.

Sample Row from Arrests Dataset

```

294391
ARREST_KEY      186183469
ARREST_DATE     08/08/2018
ARREST_BORO     queens
ARREST_PRECINCT 110
year            2018

```



Average Number of Arrests per Year by Borough

Average Number of Arrests per Year	
ARREST_BORO	
bronx	78593.733333
brooklyn	95430.666667
manhattan	92730.400000
queens	64696.733333
staten island	12105.866667

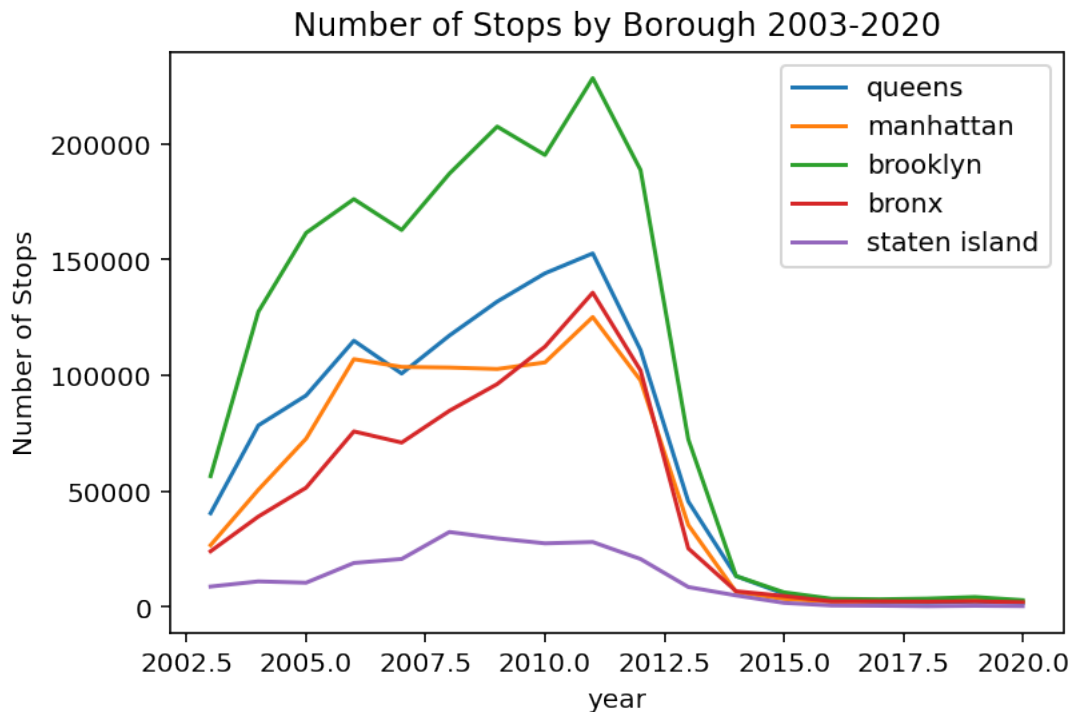
Sample Row from Stop and Frisk Dataset

95880

```

year      2004
pct       79
arstmade  False
race      BLACK
borough   brooklyn

```



Total Number of Stops Made by Borough 2003-2020

	borough	count
0	bronx	841355
1	brooklyn	1801180
2	manhattan	953880
3	queens	1158819
4	staten island	226276

Again, the assumption regarding true underlying base rates of substantiation is that substantiation rates should be the same across complainant ethnicity and location, i.e., all complainant ethnicities and boroughs are equally likely to submit a legitimate complaint. Conditioned on levels of police presence, boroughs should see the same rates of substantiation. To calculate demographic parity, boroughs with the closest values for average number of arrests/stops per year will be compared.

## 4 Quantitative Measures of Fairness

Since the dataset does not have an attribute indicating whether the CCRB’s ruling is correct, only demographic parity can be calculated.

### 4.1 Demographic Parity of Ethnicity

We expect the rates of substantiation to be similar for complaints submitted by Black complainants and non-Black complainants:  $P(\text{disposition} = \text{Substantiated} \mid \text{complainant ethnicity} = \text{Black}) = P(\text{disposition} = \text{Substantiated} \mid \text{complainant ethnicity} \neq \text{Black})$ . In the dataset, complaints submitted by Black people are substantiated 2% less. A hypothesis test is used to verify this violation of demographic parity:

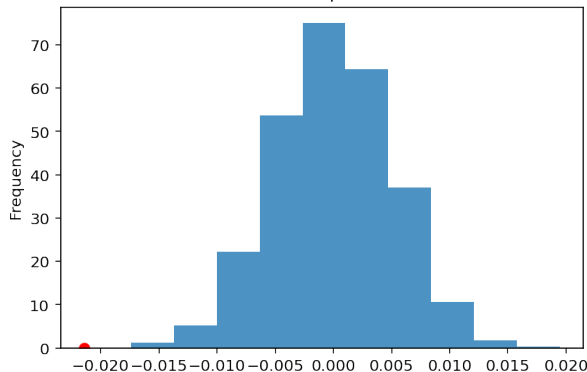
$H_0$ : The proportion of complaints by Black complainants that are substantiated is the same for complaints by non-Black complainants.

$H_A$ : The proportion of complaints by Black complainants that are substantiated is less than that for complaints by non-Black complainants.

The observed difference falls outside of this distribution and the p-value is much lower than  $\alpha = 0.001$ , warranting rejection of  $H_0$ . It seems that whether a complaint is substantiated is not independent of complainant ethnicity, violating demographic parity.

Observed Difference in Substantiation Rate for Black vs. non-Black Complainants:  
-0.021414155190785017

Simulated Difference in Substantiation Rates for Black Complainants and non-Black Complainants; p-value: 0.000000



### 4.2 Demographic Parity of Boroughs

Presumably, complaints occurring in boroughs with similar levels of police presence have similar rates of substantiation because the likelihood of police interaction and the likelihood of an interaction that warrants a complaint are presumably related to levels of police presence. More police presence could be associated with higher levels of substantiation rate due to the presumed increase in frequency of interactions with an officer that warrant a complaint. Alternatively, more of police presence could be associated with lower levels of substantiation rates because the complainant could be more likely to be a criminal and make a false complaint or an officer could have more jurisdiction and thus be given the benefit of the doubt. Demographic parity of boroughs

assumes that boroughs with similar levels of police presence (as measured by average number of arrests/stops) should have similar rates of substantiation. Manhattan and Brooklyn and Queens and the Bronx have the closest vales for average number of arrests per year and thus will be compared. Staten Island is on its own with a much lower average number of arrests per year. Thus we expect:  $P(\text{Substantiated} \mid \text{Borough} = \text{Brooklyn}) = P(\text{Substantiated} \mid \text{Borough} = \text{Manhattan})$  and  $P(\text{Substantiated} \mid \text{Borough} = \text{Queens}) = P(\text{Substantiated} \mid \text{Borough} = \text{the Bronx})$  to hold for demographic parity. Since Staten Island is so drastically different from the other boroughs, we would expect its substantiation rate to also be different.

Although the proportion of complaints occurring in Brooklyn is over double that for Manhattan, complaints occurring Brooklyn are substantiated 4.6% less often. Another hypothesis test will be conducted to see if the violation of demographic parity holds:

$H_0$ : The proportion of complaints from Brooklyn that are substantiated is the same for complaints from Manhattan.

$H_A$ : The proportion of complaints from Brooklyn that are substantiated is less than that for complaints from Manhattan.

The p-value is much lower than  $\alpha = 0.001$ , leading us to reject  $H_0$  and violating demographic parity. Despite having similar levels of police presence, complaints occurring in Brooklyn are less likely to be substantiated than complaints occurring in Manhattan.

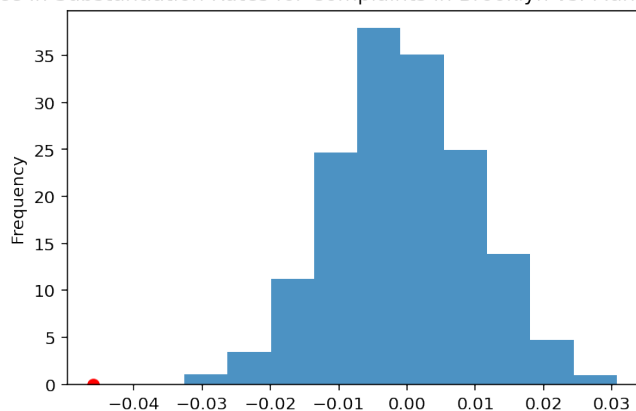
While complaints occurring in the Bronx are substantiated 1.7% less of the time than complaints submitted in Queens, despite these boroughs having similar levels of police presence, the hypothesis test says otherwise. With a p-value much higher than  $\alpha = 0.001$ , we fail to reject  $H_0$ , suggesting that substantiation rates for the Bronx and Queens are fairly similar.

#### Substantiation Rates for Brooklyn vs. Manhattan

substantiated	Substantiated	Overall Proportion
borough		
brooklyn	0.226688	0.380832
manhattan	0.272582	0.160588

Observed Difference in Substantiation Rate for Brooklyn vs. Manhattan:  
-0.045893999999999999

Simulated Difference in Substantiation Rates for Complaints in Brooklyn vs. Manhattan; p-value: 0.000000

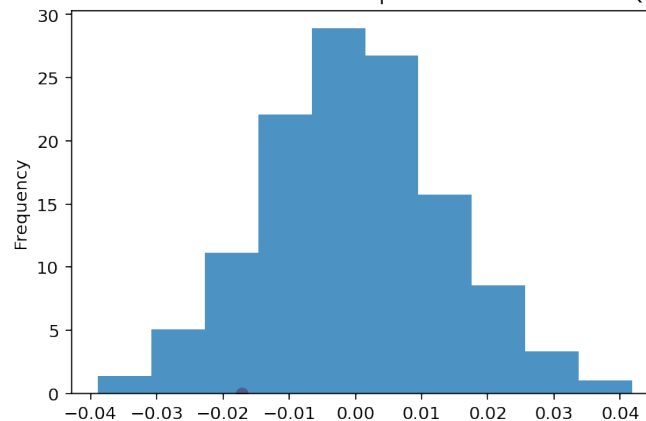


### Substantiation Rates for the Bronx vs. Queens

substantiated	Substantiated	Overall Proportion
borough		
bronx	0.253595	0.251657
queens	0.270747	0.139678

Observed Difference in Substantiation Rate for the Bronx vs. Queens: -0.017152

Simulated Difference in Substantiation Rates for Complaints in the Bronx vs. Queens; p-value: 0.110000



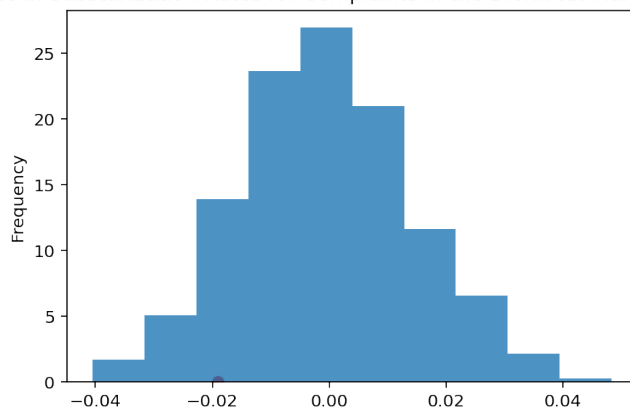
When looking at the stops data, there is a different grouping. Manhattan, the Bronx, and Queens have the most similar number of stops per year. Brooklyn is on its own with the highest number of stops, and Staten Island is on its own with the lowest. Thus we expect:  $P(\text{Substantiated} \mid \text{Borough} = \text{Manhattan}) = P(\text{Substantiated} \mid \text{Borough} = \text{the Bronx}) = P(\text{Substantiated} \mid \text{Borough} = \text{Queens})$ . Although complaints occurring in the Bronx are substantiated nearly 2% less of the time than complaints submitted in Manhattan and Queens, the hypothesis test says otherwise. With a p-value much higher than  $\alpha = 0.001$ , we fail to reject  $H_0$ , suggesting that substantiation rates for the Bronx, Manhattan, and Queens are fairly similar and that demographic parity holds.

### Substantiation Rates for the Bronx vs. Queens vs. Manhattan

substantiated	Substantiated	Overall Proportion
borough		
bronx	0.25	0.251657
manhattan	0.27	0.160588
queens	0.27	0.139678

Observed Difference in Substantiation Rate for the Bronx vs. Manhattan:  
-0.018986999999999976

Simulated Difference in Substantiation Rates for Complaints in the Bronx vs. Manhattan; p-value: 0.095000



### 4.3 Other Parity Metrics and the Limitations of the Dataset

In this context, the classifier is the CCRB deciding whether the allegation truly happened and violated NYPD rules, warranting substantiation. The ground truth is whether this classifier is correct. Since the review board cannot truly know whether an allegation actually took place, the closest way for the ground truth to be determined is to: conduct questioning of the accused officer and the complainant, conduct a trial by jury, and require the NYPD to provide any relevant evidence (e.g., body camera footage). While this couldn't capture the exact truth in all cases, it is the besting thing present in the criminal justice system. For this classifier, a false positive refers to a complaint that was substantiated by the CCRB, but the allegation did not actually occur (as determined by the steps explained above). A false negative is when a complaint was not substantiated by the CCRB, but the trial found that the allegation actually occurred. The complainant, who seeks a sense of justice through getting substantiated, would be more hurt by a false negative. For a police officer, who has a reputation and livelihood to maintain, a false positive would be more detrimental.

#### 4.3.1 Accuracy Parity

Accuracy parity would require the accuracy of the CCRB to be equal across complainant ethnicity and borough of complaint (conditioned on level of police presence). However, since the impacts of false positives and false negatives differ depending on whether one is the complainant or accused officer, accuracy parity would not be applicable. For example, if the classifier had equally high false negative rates for all complainants, then no complainants would benefit; only officers would benefit.

#### 4.3.2 Equality of Odds

Equality of odds would require that the false positive and true positive rates are the same for all complainants. The classifier in question could be thought of as allocating a beneficial thing, substantiation. The complainant benefits from substantiation by receiving a notion of justice or retribution. The public benefits from substantiation because the officers who may otherwise continue violating NYPD rules are punished, preventing further complaints. Additionally, the NYPD could benefit from substantiation because punishing officers that violate NYPD rules makes the

NYPD appear more reputable and honorable. Thus, equality of odds would be a more appropriate parity measure to enforce than accuracy parity.

### 4.3.3 Predictive Value Parity

Positive predictive value parity would require that the chance of success (true positive) be the same across groups. This means that across complainant ethnicity and borough, complaints that actually occurred should have the same chance of being substantiated. Negative predict value parity would require that the chance of a true negative, meaning a complaint that did not actually occur does not get substantiated, be equal across complainant ethnicity and borough. Enforcing both conditions would be appropriate in this context. Since predictive value parity would require that deserving complainants receive a sense of justice and officers are not wrongly punished, this parity metric would be the best to apply to these complaints.

## 5 Interpretation of Results and Conclusion

Black civilians' complaints are substantiated less often than non-Black civilians', and this discrepancy is statistically significant. Based on this violation of demographic parity, the CCRB does not seem to be fair in reviewing civilian complaints. When comparing substantiation rates by borough, complaints occurring in Brooklyn were substantiated 4.6% less than complaints occurring in Manhattan, despite these boroughs having similar levels of police presence, violating demographic parity. Even when accounting for levels of police presence, it seems that the CCRB was not fair towards Brooklyn. For boroughs with lower levels of police presence, the Bronx and Queens, the hypothesis test suggested that demographic parity was not violated. When using the number of stops made as a proxy for police presence, the three boroughs with similar levels, Queens, the Bronx, and Manhattan, seemed to have similar levels of substantiation.

Although it is assumed that the base rates are equal across complainant ethnicity (no ethnicity is more likely to submit a false complaint), this assumption may not be true in reality. If the underlying base rates of substantiation should actually differ across groups, then it'd be expected for demographic parity to be violated. Demographic parity could be violated because the CCRB may not weigh the allegations of a Black complainant in the same manner as they might for a non-Black complainant. The frequency of complaints made by Black people relative to other ethnicities may make the CCRB substantiate their complaints at a different rate. For example, since an Asian person is much less likely to submit a complaint, the CCRB may take the Asian person's allegation more seriously than a Black person's and thus be more likely to substantiate the Asian person's complaint. While this does not seem to be fair, as such logic is explicitly biased against one group, it could explain why demographic parity was violated. A similar logic can be applied to explain why demographic parity by borough was violated. Since someone from Queens is much less likely to submit a complaint than someone from Brooklyn, the CCRB may weigh the complainant from Queens' words more heavily and be more likely to substantiate their complaint than someone from Brooklyn.

As mentioned before, the dataset and using demographic parity to analyze the potential inequity in substantiation rates has many limitations. Since there is no real way to uncover the ground truth, it is difficult to identify any irrefutable inequity using only the data. Furthermore, since Black complainants and complainants from Brooklyn are overrepresented in the dataset, the observed substantiation rates could actually be closer to the truth. In other words, since there is limited data on complaints from non-Black people and from outside of Brooklyn, the substantiation rates



for these groups may be inflated. All in all, while analyzing this discrepancy in substantiation rates across complainant ethnicity using data has its limits, a qualitative investigation could be more useful in exploring this potential inequity.

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