UCONN
INSTITUTE FOR MUNICIPAL AND REGIONAL POLICY

CONNECTICUT RACIAL PROFILING PROHIBITION PROJECT

TRAFFIC STOP DATA ANALYSIS AND FINDINGS, 2021

RELEASED

OCTOBER 2023

www.ctrp3.org

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This report was written by the Institute for Municipal and Regional Policy (IMRP) at the University of Connecticut with the help of Matthew B. Ross and Jesse Kalinowski who applied the statistical tests known as the "Veil of Darkness", "Synthetic Control", "Stop Disposition", and "KPT Hit Rate."

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PREAMBLE

This preamble was written by an ad-hoc committee of the Connecticut Racial Profiling Prohibition Project advisory board and endorsed unanimously by the board on December 6, 2018.

1. Racial Profiling has historically occurred and continues to occur throughout America.
2. The Alvin W. Penn Racial Profiling Law enacted by the Connecticut General Assembly in 1999 required state and local police to collect traffic stop data and report the data to the state.
3. The 2011 federal investigation into the East Haven Police Department brought this issue to the forefront in Connecticut again and led to the Connecticut General Assembly updating the Profiling Legislation in 2012.
4. Disparities across racial and ethnic groups occur in traffic stops in Connecticut.
5. Enforcing the law's data reporting requirement and collecting and analyzing racial disparities in traffic stop records in the primary charge of the advisory board.
    a. A broader analysis, utilizing multiple methodologies in the preferred method for measuring for the presence of racial disparities in traffic enforcement;
    b. Although no measure is 100% accurate in measuring disparities, the analysis utilized in Connecticut is sufficient in determining the presence of disparities;
    c. We will continue to modify and refine our methodologies based on the best available research and accepted practices in the field.
6. We will take a proactive approach in understanding, explaining and addressing disparities found in the analysis by:
    a. Utilizing input from all stakeholders to understand the underlying causes for such disparities;
    b. Clearly explaining to the public and stakeholders if there are justifiable reasons for such disparities;
    c. Reporting to the Office of Policy and Management instances where the Connecticut Racial Profiling Prohibition Project Advisory Board believes that a police department is in violation of the Alvin W. Penn law.

EXECUTIVE SUMMARY OF FINDINGS

The Alvin W. Penn Racial Profiling Prohibition Act (Public Act 99-198) was first enacted in 1999 in the State of Connecticut. The law prohibits any law enforcement agency in the state from stopping, detaining, or searching motorists when the stop is motivated solely by considerations of the race, color, ethnicity, age, gender, or sexual orientation of that individual (Connecticut General Statutes Sections 54-1l and 54-1m). In 2012 and 2013, the Connecticut General Assembly made several major revisions to the law in an effort to ensure its effective implementation. In accordance with these changes, police agencies began collecting data pertaining to all traffic stops on October 1, 2013.

In 2012, the Racial Profiling Prohibition Project Advisory Board was established to advise the Office of Policy and Management (OPM) in adopting the law's standardized methods and guidelines. The Institute for Municipal and Regional Policy (IMRP) at Central Connecticut State University was tasked to help oversee the design, evaluation, and management of the racial profiling study mandated by Public Act No. 12-74 and Public Act No. 13-75, "An Act Concerning Traffic Stop Information." The project staff worked with the state's Criminal Justice Information System (CJIS) to develop a system to collect consistent and universal traffic stop information and submit it to CJIS electronically on a monthly basis.

In Connecticut, there are a total of 94 municipal police departments: 29 departments employing more than 50 officers, 50 employing between 20 and 50 officers, and 15 with fewer than 20 officers. State police are comprised of 11 distinct troops. Although there are an additional 80 jurisdictions that do not have organized police departments and are provided police services by the state police, either directly or through provision of resident troopers, these stops were categorized with their overarching state police troops. Additionally, a total of 13 special agencies has the authority to conduct traffic stops.

As per section 54-1m of the Connecticut General Statutes, the IMRP is required to submit an annual report analyzing traffic stops records for all police departments in Connecticut. This is the seventh annual report published by the IMRP and presents the results from an analysis of approximately 274,000 traffic stops conducted during the 12-month study period from January 1, 2021 through December 31, 2021. It also presents a three-year aggregate analysis of the approximately 1,025,000 traffic stops conducted between January 1, 2019 to December 31, 2021. This report serves as a screening tool, essentially highlighting areas where disparities between races and ethnicities are greatest in traffic enforcement throughout the state.

All departments and communities would benefit from carefully reviewing the findings in this report. Addressing statewide racial and ethnic disparities will require a collective effort of all law enforcement and community stakeholders. An atmosphere of open-mindedness, empathy, and honesty from all stakeholders remains necessary to create sustained police legitimacy and a safer, more just society. The authors of this report are hopeful that the information contained herein will be valuable to the citizens of Connecticut as they seek to fulfill the promise of the Alvin W. Penn Act. We are both humbled and grateful for the opportunity to be part of this important effort.

E.1: 2021 AND 2019-21 STATEWIDE TRAFFIC STOP ANALYSIS AND FINDINGS

Assessing racial disparities in policing data has been used for the last two decades as a policy tool to evaluate whether there exists the possibility that racial and ethnic bias is occurring within a given jurisdiction. The statistical evaluation of policing data in Connecticut is an important step towards developing a transparent dialogue between law enforcement and the public at large. As such, it is the goal of this report to present the results of that evaluation in the most transparent and unbiased manner possible. The report is organized to lead the reader through seven distinct analytical tests that vary in their assumptions and level of scrutiny. The intent behind this approach is to apply multiple tests as a screening filter for the possibility that any one test (1) produces false positive results or (2) reports a false negative.

The research strategy underlying the statistical analysis presented in chapters three through seven of this report was developed with three guiding principles in mind. Each principle was considered throughout the research process and when selecting the appropriate results to display publicly. A better understanding of these principles helps to frame the results presented in the technical portions of the analysis. In addition, by presenting these principles at the onset of the report, readers have a better context to understand the overall framework of the approach.

> *Principle 1: Acknowledge that statistical evaluation is limited to finding racial and ethnic disparities that are indicative of racial and ethnic bias but that, in the absence of a formal procedural investigation, cannot be considered comprehensive evidence.*
>
> *Principle 2: Apply a holistic approach for assessing racial and ethnic disparities in Connecticut policing data by using a variety of approaches that rely on well-respected techniques from existing literature.*
>
> *Principle 3: Outline the assumptions and limitations of each approach transparently so that the public and policy makers can use their judgment in drawing conclusions from the analysis.*

We emphasize the message that any statistical test is only truly capable of identifying racial and ethnic disparities. Such findings provide a mechanism to indicate possible racial profiling, but they cannot, without further investigation, provide sufficient evidence that racial profiling exists.

E.1 (A): Findings from the Statewide Analysis

Municipal and State Police departments in Connecticut made 274,432 traffic stops in 2021 (1,029,511 in 2019-21) of which 61% were of White non-Hispanic motorists while 19% were Black and 18% were of Hispanic motorists. Recorded traffic stops increased by 13% in 2021 compared to 2020 but remained 46% lower than 2019. State police saw a further decline in recorded traffic stops in 2021 with a 3.5% decrease compared to 2020 and a remain 53% lower than 2019. Municipal police increased recorded traffic stops by 18% in 2021 compared to 2020, but still remain 43% lower than 2019.

At the aggregate level, we present estimates from applying the veil of darkness analysis, a search hit-rate analysis, and a post-stop disposition analysis. The veil of darkness analysis exploits quasi-random variation in the timing of sunset to identify potential discrimination in the decision to stop a

motorist. According to the results from applying this test, the estimated change from daylight to darkness in the odds a stopped motorist is a Black was 0.97 in 2019 and 2020 but 0.98 in 2021. The change from daylight to darkness in the odds a stopped motorist is Hispanic was 1.06 in 2019 but 1.04 in 2020 and 2021. The key identifying assumption of this test is that police officers who are inclined to racially profile motorists are better able to do so during daylight when motorist race is more easily observed prior to making a traffic stop. According to this logic and the application of the test to the 2021 traffic stop data, Connecticut police were not any more likely to stop Black or Hispanic motorists.

In 2021, Municipal and State Police departments in Connecticut also conducted a total of only 7,365 (2.75%) motor vehicle searches of which 32% were of non-Hispanic Caucasian motorists while 37 % were of Black and 30% were of Hispanic motorists. At the aggregate level, we present estimates comparing the likelihood a search resulted in contraband being found for non-Hispanic Caucasian motorists relative to minority motorists. In addition, we compare the disposition of traffic stops across these groups after conditioning on the motivating reason for the traffic stop. The rate at which discretionary searches of non-Hispanic Caucasian motorists yielded contraband was 49% in 2019, 50% in 2020, and 52% in 2021. The rate at which searches of Black and Hispanic motorists yielded contraband was 38% and 41% respectively in 2019, 42% and 44% respectively in 2020, and 45% and 46% respectively in 2021. The key identifying assumption of this test is that, if police are unbiased, they will only search minority motorists more often than whites relative to their expected likelihood of carrying contraband. The lower hit-rate for minority motorists is suggestive of potential bias on the part of police. The stop disposition analysis did not reveal any discernible pattern in terms of how minority motorists are treated following a traffic stop but did indicate that they faced statistically different outcomes.

Veil of Darkness Analysis Findings, 2021 and 2019-21

In an effort to better identify the source of these racial and ethnic disparities, each analysis was repeated at the department level for both the 2021 calendar year and the 2019 to 2021 aggregate sample. The threshold for identifying individual departments was the presence of a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories.[1] By construction, the departments that were identified as having a statistically significant disparity are the largest contributors to the overall statewide results. Here, the unit of analysis is a municipal department or State Police Troop where disparities could be a function of a number of factors including institutional culture, departmental policy, or individual officers.[2]

In total, we identify three State Police Troops in the three-year aggregate sample. State Police Headquarters and Troop D were also identified in our 2020 analysis. We also identified one municipal police department in the three-year aggregate sample. The municipal police department has been identified in several previous annual studies across multiple measures. For all departments identified in this report, we conclude that there is strong evidence that a disparity exists in the rate of minority traffic stops made during daylight conditions. These departments include:

[1] Put simply, there must have been at least a 95 percent chance that the motorists were more likely to be stopped at a higher rate relative to white Non-Hispanic motorists.

[2] Since department or state police barrack estimates represent an average effect of stops made by individual officers weighted by the number of stops that they made in 2018, it is possible that officer-level disparities exist in departments which were not identified.

State Police Headquarters

State Police Headquarters was identified on the veil of darkness analysis in 2019-21 sample for both Black and Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black or Hispanic totaled 0.24 and 0.25 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black or Hispanic grew to 0.34 and 0.31 during daylight when we presume that police are better able to detect race.

State Police Troop D

State Police Troop D was identified on the veil of darkness analysis in 2019-21 sample for Black motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black totaled 0.07 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black grew to 0.10 during daylight when we presume that police are better able to detect race.

State Police Troop H

State Police Troop H was identified on the veil of darkness analysis in 2019-21 sample for Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Hispanic totaled 0.36 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Hispanic grew to 0.48 during daylight when we presume that police are better able to detect race.

Wethersfield:

Wethersfield was identified on the veil of darkness analysis in 2019-21 sample for both Black and Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black or Hispanic totaled 0.26 and 0.45 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black or Hispanic grew to 0.38 and 0.56 during daylight when we presume that police are better able to detect race.

Other Statistical and Descriptive Measure Analysis Findings, 2021 and 2019-21

In addition to the three State Police troops and one municipal police department identified to exhibit statistically significant racial or ethnic disparities in the Veil of Darkness analysis, a number of other departments were identified using either the descriptive tests, stop disposition test or KPT hit-rate analysis. These additional tests are designed as an additional screening tool to identify the

jurisdictions where consistent disparities exceed certain thresholds that appear in the data. Although it is understood that certain assumptions have been made in the design of each of these measures, it is reasonable to believe that departments with consistent data disparities that separate them from the majority of other departments should be subject to further review and analysis with respect to the factors that may be causing these differences.

The results from estimating whether individual departments stopped more minority motorists relative to their requisite synthetic control found 28 municipal police departments, and 3 State Police troops to have a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories and withstood doubly-robust estimation, and had a false discovery rate below 10%. *Brookfield, Troop H, East Haven, Farmington, Meriden, New London, North Haven, Orange, Wallingford, Waterford, Watertown,* and *Wethersfield* were identified in the 2021 sample and the aggregate 2019 to 2021 sample. *Avon, Bridgeport, Cheshire, Troop K, Hamden, New Canaan, Stratford,* and *Windsor Locks* were identified only in the 2021 sample. Lastly, *Troop I, Derby, Granby, Monroe, New Haven, Newington, Plainville, Plymouth, Stonington, Wilton,* and *Wolcott* were identified only in the three-year aggregate analysis.

The descriptive tests are designed as an additional tool to identify disparities that exceed certain thresholds that appear in a series of census-based benchmarks. The two descriptive benchmarks used are: (1) statewide average and (2) resident-only stops. Although 55 municipal police departments were identified with racial and ethnic disparities when compared to one or more of the descriptive measures, only *Naugatuck, New Britain, Derby, Stratford, Enfield, Newington, and Vernon* exceeded the disparity threshold in both measures with a score more than half the benchmark total.

In contrast to prior years, we find no discernible pattern that minority motorists are treated differently in any unform way relative to their non-Hispanic Caucasians counterparts. There were no departments found to have a statistically significant disparity in post-stop outcomes in 2021.

The results of this test, applied to the aggregate search data for all departments in Connecticut show that departments are less successful in motorist searches across all minority groups, which is a potential indicator of disparate treatment. There was no municipal police departments or State Police Troops found to have a disparity in the hit-rate of minority motorists relative to White non-Hispanics motorists for the 2021 sample. In the combined 2019-21 aggregate sample, there was one municipal police department found to have a disparity in the hit-rate of minority motorists relative to White non-Hispanic motorists. The one municipal department identified to exhibit a statistically significant racial or ethnic disparity in searches were:

Hartford:

Hartford was identified on the search hit-rate analysis in the combined 2019-21 sample for both Black and Hispanic motorists. This analysis compares the rate at which searched minority motorists are actually found with contraband to the same majority rate. In the data, contraband was found in only 20% of Black and 26% of Hispanic discretionary searches. Relative to the 41% of non-Hispanic Caucasian motorists, searches of minority motorists were less successful and suggestive of potential adverse treatment.

E.1 (B): Conclusions from the Statewide Analysis

The analysis presented in chapters III through VII of this report should be utilized as a screening tool by which researchers, law enforcement administrators, community members and other appropriate

stakeholders focus resources on those departments displaying the greatest level of disparities in their respective stop data. As noted previously, racial and ethnic disparities in any traffic stop analysis do not, by themselves, provide conclusive evidence of racial profiling. Statistical disparities do, however, provide significant evidence of the presence of idiosyncratic data trends that warrant further analysis.

In order to determine if a departments racial and ethnic disparities warrant additional in-depth analysis, researchers review the results from some of the analytical sections of the report. The threshold for identifying significant racial and ethnic disparities for departments is described in each section of the report (ex. departments with a disparity that was statistically significant at the 95 percent level in the black or Hispanic alone categories in the Veil of Darkness methodology were identified as statistically significant). A department is identified for a follow-up analysis if they meet any one of the following criteria:

1. A statistically significant disparity in the one-year or three-year Veil of Darkness analysis
2. A statistically significant disparity in the one-year or three-year KPT hit rate and Stop Disposition analyses

It is worth noting that past reports have relied on results from the Synthetic Control method and Descriptive Statistics to identify departments for additional analysis. Although results from those methods are provided in the report, the authors believe that since 2010 census information forms much of the foundation of these measures, it would be better appropriate to limit the use of these tests until 2020 census data has been fully incorporated into the analysis. The authors also believe that the inclusion of a three-year aggregate analysis significantly improves our ability to utilize the more sophisticated statistical techniques, especially on departments with small annual sample sizes. Improvements have also been made to the post-stop measures to make them more rigorous and statistically sound.

In general, we continue to identify far fewer departments in this report relative to the previous year's studies with only one municipal department and three State Police troops. The municipal department and three State Police Troops were identified in the three-year aggregate sample only. Although the municipal police department and three State Police troops meet the criteria for an in-depth follow-up analysis, we are not recommending any be conducted at this time.

The **Wethersfield** police department has been identified with statistically significant disparities in this study and several previous studies. Since 2015, the project staff have conducted three follow-up analyses to understand better the factors contributing to racial and ethnic disparities in Wethersfield. In this study, the department's statistically significant disparity only appeared in the three-year aggregate analysis and was not identified when researchers analyzed 2020 and 2021 alone. It is evident that the 2019 data is significantly contributing to the disparity highlighted in the three-year aggregate analysis. A new police chief, who revised the command staff, was brought in by town officials in 2021 to address this and other issues within the department. Based on conversations with the agency, we believe reforms have been and continue to be implemented that will address the disparities outlined in this report. Therefore, it is reasonable that any changes made by the department would not be reflected in their data until 2022 and 2023. Since the three-year aggregate analysis covers a significant portion of time prior to changes in leadership, it is unsurprising that the department would continue to show statistically significant racial and ethnic disparities. We will

continue monitoring the department's data to assess changes in their racial and ethnic disparities in more recent years.

The report also identified **State Police Headquarters**, **Troop D**, and **Troop H** with statistically significant racial and ethnic disparities. All three troops were identified in the three-year aggregate analysis but were not identified in the analysis of only 2021 data. Prior to the publication of this report, the project staff discovered substantial data discrepancies with state police infraction records submitted to the racial profiling database between 2014 and 2021. In June 2023, the project released a comprehensive audit outlining the findings. In order to more fully evaluate and resolve the discrepancies highlighted in the 2023 audit, the project staff decided not to conduct a follow-up analysis on any state police troop barracks at this time.

Lastly, in addition to being identified with racial and ethnic search disparities in this study, the **Hartford** police department was identified with racial and ethnic search disparities in the 2020 Traffic Stop Data Analysis and Findings report. The large and consistent nature of these disparities warrant additional analysis of search records by Hartford.

BACKGROUND

First enacted in 1999, Connecticut's anti-racial profiling law entitled, the Alvin W. Penn Racial Profiling Prohibition Act (Public Act 99-198), prohibits any law enforcement agency from stopping, detaining, or searching any motorist when the stop is motivated solely by considerations of the race, color, ethnicity, age, gender or sexual orientation of that individual (Connecticut General Statutes Sections 54-1l and 54-1m). In 2012 and 2013, the Connecticut General Assembly made several changes to this law to create a system to address racial profiling concerns in Connecticut.

In 2012, the Racial Profiling Prohibition Project Advisory Board was established to advise OPM in adopting the law's standardized methods and guidelines. The Institute for Municipal and Regional Policy (IMRP) at UConn was tasked to help oversee the design, evaluation, and management of the racial profiling study mandated by PA 12-74 and PA 13-75, "An Act Concerning Traffic Stop Information." The IMRP worked with the advisory board and all appropriate parties to enhance the collection and analysis of traffic stop data in Connecticut.

Through September 30, 2013, police agencies collected traffic stop information based on requirements outlined in the original 1999 Alvin W. Penn law. Beginning October 1, 2013, police agencies had to submit traffic stop data for analysis under the new methods outlined by the Office of Policy and Management (OPM), as required by the amended racial profiling prohibition law. The law also authorized the OPM secretary to order appropriate penalties (i.e., the withholding of state funds) when municipal police departments, the Department of Emergency Services and Public Protection (DESPP), and other police departments fail to comply.

The National Highway Traffic and Safety Administration (NHTSA) provided resources for this project through a grant administered by the Connecticut Department of Transportation. The Racial Profiling Prohibition Project Advisory Board and the project staff have been meeting since May 2012 in an effort to outline a plan to successfully implement the requirements of the 2012 and 2013 legislation. The focus of the project's early phase was to better understand traffic stop data collection in other states. After an extensive review of best practices, working groups were formed and met monthly to discuss the different aspects of the project. These working groups included Data and System, Public Awareness, and Training work groups. The full advisory board held more than 25 meetings and the working groups met approximately 60 times.

The advisory board and IMRP also worked with law enforcement officials to create a data collection system that is efficient, not burdensome to the police collecting it, and provides information that is easy to work with when it is submitted. Police agencies in Connecticut vary in their levels of sophistication and technological capacity with respect to how they collect and report data. The project staff worked with the state's Criminal Justice Information System (CJIS) to develop a system to collect consistent and universal traffic stop information and submit it to CJIS electronically on a monthly basis.

The IMRP developed and maintains a project website (www.ctrp3.org) that informs the public of the advisory board's activities, statewide informational forums, and related news items on racial profiling. The website includes meeting agendas and minutes, press releases, and links to register for events. The website is updated weekly. In addition to the project website, the IMRP partnered with the Connecticut Data Collaborative to publish all traffic stop data on a quarterly basis. The public can

download the information in its original form or view summary tables for easy use. A full set of analytical tools will be available for more advanced users who are interested in data analysis.

Although much of the initial focus of this project was to develop a standardized method for data collection and analysis, there are other important components. The initiatives include a public awareness and education campaign, effective training for officers and departments, and a rigorous complaint process. Information about all of these initiatives is provided on the project website. These initiatives collectively represent different tools available for education and the prevention of racial profiling in policing. These tools were implemented in the hope of building and enhancing trust between communities and law enforcement in Connecticut.

In February 2014, the U.S. Department of Justice, Community Oriented Policing Services Division, sponsored a train-the-trainer program in Connecticut on "Fair and Impartial Policing (FIP)." The FIP program was established to train police officers and supervisors on fair and impartial policing by understanding both conscious and unconscious bias. This program was offered to police agencies throughout the state over the next year.

Lastly, a major component of addressing concerns about the possibility of racial profiling in Connecticut is bringing law enforcement officials and community members together to discuss relationships between police and the community. The project staff has conducted several public forums throughout the state to bring these groups together and will continue these dialogues in the foreseeable future. They serve as an important tool to inform the public of their rights and the role of law enforcement in serving their communities.

I: METHODOLOGICAL APPROACH UNDERLYING THE ANALYSIS

Assessing racial disparities in policing data has been used for the last two decades as a policy tool to evaluate whether racial bias exists within a given jurisdiction. Although there has always been widespread public support for the equitable treatment of individuals of all races, recent national headlines have brought this issue to the forefront of American consciousness and prompted a contentious national debate about policing policy. The statistical evaluation of policing data in Connecticut is an important step towards developing a transparent dialogue between law enforcement and the public. As such, this report's goal is to present the results of that evaluation in a transparent and unbiased manner.

The research strategy underlying this statistical analysis was developed with consideration to three guiding principles. Each principle served as an important foundation for the research process, particularly when selecting the appropriate results to disseminate to the public. A better understanding of these principles helps to frame the results in the technical portions of the analysis. Further, presenting these principles at the outset of the report provides readers with the appropriate context to understand our overall approach.

> *Principle 1: Acknowledge that statistical evaluation is limited to finding racial and ethnic disparities that are indicative of racial and ethnic bias but that, in the absence of a formal procedural investigation, cannot be considered comprehensive evidence.*
>
> *Principle 2: Apply a holistic approach for assessing racial and ethnic disparities in Connecticut policing data by using a variety of approaches that rely on well-respected techniques from existing literature.*
>
> *Principle 3: Outline the assumptions and limitations of each approach transparently so that the public and policy-makers can use their judgment in drawing conclusions from the analysis.*

The report is organized to lead the reader through a host of descriptive and statistical tests that vary in their assumptions and level of scrutiny. The intent behind this approach is to apply multiple tests as a screening filter for the possibility that any one test (1) produces false positive results or (2) reports a false negative. Seven distinct analytical tools were used to evaluate whether racial and ethnic disparities are present in the Connecticut policing data. In the analysis, the demography of motorists was grouped into four overlapping categories to ensure a large enough sample size for the statistical analysis. Although much of the analysis focuses on stops made of black (Hispanic or non-Hispanic) and Hispanic motorists (any race), the analysis was also conducted for aggregated groupings of all non-white motorists (Hispanic or non-Hispanic) as well as a combined sample of black and Hispanic motorists. In terms of identifying departments or state police barracks in individual tests, the estimated disparity (i.e. the higher likelihood of stopping a minority motorist) must have been estimated with at least a 95 percent level of statistical significance for either black or Hispanic motorists alone. Put simply, under the rigorous conditions set by each test, there must have

been at least a 95 percent chance that either black or Hispanic motorists were more likely to be stopped (or searched) at a higher rate relative to Caucasian non-Hispanic motorists.

The analysis begins by first presenting a method referred to as the Veil of Darkness was used to assess the existence of racial and ethnic disparities in stop data. The test is a statistical technique that was developed by Jeffery Grogger and Greg Ridgeway (2006) and published in the *Journal of the American Statistical Association*. The Veil of Darkness analysis examines a restricted sample of stops occurring during the "inter-twilight window" and assesses relative differences in the ratio of minority to non-minority stops that occur in daylight as compared to darkness. The inter-twilight window restricts stops to a fixed window of time throughout the year when visibility varies due to seasonality as well as the discrete daylight savings time shift. This technique relies on the idea that, if police officers are profiling motorists, they are better able to do so during daylight hours when race and ethnicity is more easily observed. After restricting the sample of stops to the inter-twilight window and controlling for things like the time of day and day of week, any remaining difference in the likelihood a minority motorist is stopped during daylight is attributed to disparate treatment. This analytical approach is considered the most rigorous and broadly applicable of all the tests presented in this report.

The second analytical tool used in the analysis is the synthetic control where the number of minority traffic stops in a given department is evaluated against a benchmark constructed using stops made by all other departments in Connecticut. Since departments differ in terms of their enforcement activity (i.e. time of stops, reason for stops, etc.) and the underlying demographics of the population on the roadway, this analysis relies on the rich statistical literature on propensity scores. Here, a propensity score is a measure of how similar a stop made outside a given department is to a stop made by the department being analyzed. These measures of similarity are used to weight stops when constructing an individual benchmark for each department. For example, if the department being analyzed has a high minority population and makes most of their stops on Friday nights at 7PM for speeding violations then stops made for speeding violations by departments with a similar residential population at this time and day will be given more weight when constructing the benchmark. This methodology ensures that there is an apples-to-apples comparison between the number of minorities stopped in a given town relative to their benchmark and allows for the interpretation of any remaining differences to be attributed to possible disparate treatment.

The three techniques contained in Chapter 5 are descriptive in nature and compare department-level data to three benchmarks (statewide average, estimated commuter driving populations, and resident population). These methods are referred to as population benchmarks and are commonly used to evaluate racial disparities in police data across the country. The statewide average comparison provides a simple and effective way to establish a baseline for all departments from which the relative differences between department stop numbers and the average for the state are compared. A comparison to the statewide average is presented alongside the context necessary to understand differences between local jurisdictions. Next, researchers adjust "static" residential census data to approximate the estimated driving demographics in a particular jurisdiction. Residential census data can be modified to create a reasonable estimate of the possible presence of many nonresidents likely to be driving in a given community because they work there and live elsewhere. This estimate is a composition of the driving population during typical commuting hours based on data provided by the U.S. Census Bureau. The final population benchmark comparison limits the analysis to stops involving only residents of the community and compares them to the community demographics

based on the most recent decennial census for residents age 16 and over. Although any one of these benchmarks cannot provide by itself a rigorous enough analysis to draw conclusions regarding racial disparities, if taken together with the more rigorous statistical methods they do serve as a useful tool.

The sixth analytical tool used in the analysis tests for disparities in the outcomes of traffic stops using a model that examines the distribution of dispositions conditional on race and the reason for the stop. Specifically, we test whether traffic stops made of minority motorists result in different outcomes relative to their white non-Hispanic peers. We provide one important cautionary note about interpreting this test as causal evidence of discrimination. Ideally, this test would be performed on data containing *all* violations observed by the police officer prior to making a traffic stop and where we would include a control for the number of total violations. In practice, data on traffic stops typically only contain the most severe reason that motivated the stop. In the absence of data on the full set of violations observed by police officers, we suggest that the reader interpret results from this test as providing descriptive evidence to be viewed in concert with other such empirical measures.

Lastly, an analysis of post-stop outcomes using a hit-rate approach following a technique published in the *Journal of Political Economy* by Knowles, Persico and Todd (2001). The hit-rate approach relies on the idea that motorists rationally adjust their propensity to carry contraband in response to their likelihood of being searched by police. Similarly, police officers rationally decide whether to search a motorist based on visible indicators of guilt and an expectation of the likelihood that a given motorist might have contraband. According to the model, a demographic group of motorists would be searched by police more often than white non-Hispanic motorists if they were more likely to carry contraband. However, the higher level of searches should be exactly proportional to the higher propensity for this group to carry contraband. Thus, in the absence of racial animus, we should expect the rate of successful searches (i.e. the hit-rate) to be equal across different demographic groups regardless of differences in their propensity to carry contraband. [3] In this test, discrimination is interpreted as a preference for searching minority motorists that shows up statistically as a lower hit-rate relative to Caucasian motorists. Note that this test inherently says nothing about disparate treatment in the decision to stop motorists as it is limited in scope to vehicular searches.

In short, we move forward with the overall goal of identifying the statistically significant racial and ethnic disparities in Connecticut policing data. A variety of statistical tests are applied to the data in the hope of providing a comprehensive approach based on the lessons learned from academic and policy applications. Our explanations of the mechanisms and assumptions that underlie each of the tests are intended to provide policymakers and the public with enough information to assess the data and draw their own conclusions from the findings.

Finally, we emphasize the message that any statistical test is only truly capable of identifying racial and ethnic disparities. Such findings provide a mechanism to indicate possible racial profiling but they cannot, without further investigation, provide sufficient evidence that racial profiling exists.

[3] Although some criticism has risen concerning the technique and extensions have suggested that more disaggregated groupings of searches be used in the test, the ability to implement such improvements is limited by the small overall sample of searches in a single year of traffic stops. Despite these limitations, the hit-rate analysis is still widely applied in practice and contributes to the overall understanding of post-stop police behavior in Connecticut.

II: CHARACTERISTICS OF TRAFFIC STOP DATA

This section examines general patterns of traffic enforcement activities in Connecticut for the study period of January 1, 2021 to December 31, 2021. Statewide and agency activity information can be used to identify variations in traffic stop patterns to help law enforcement and local communities understand more about traffic enforcement. Although some comparisons can be made between similar communities, we caution against comparing agencies' data in this section of the report. Please note that the tables included in this report present information from only a limited number of departments. Complete tables for all agencies are included in the technical appendix.

In Connecticut, more than 274,000 traffic stops were conducted during the 12-month study period. Compared to the previous year, traffic enforcement increased by approximately 11% in 2021. The State of Connecticut saw a significant reduction in traffic enforcement during the COVID-19 pandemic. Although there was a small increase in traffic enforcement in 2021 compared to 2020, enforcement remains approximately 45% lower than pre-pandemic levels. The most traffic stops occur in April with an average of 32,000. This is still significantly below the pre-pandemic average for April, which was closer to 60,000 stops. Almost 72% of the total stops were conducted by the 94 municipal police departments, 27% of the total stops were conducted by state police, and the remaining 1% of stops were conducted by other miscellaneous policing agencies. Figure 2.1 shows the aggregate number of traffic stops by month along with each demographic category.

Figure 2.1: Aggregate Traffic Stops by Month of the Year

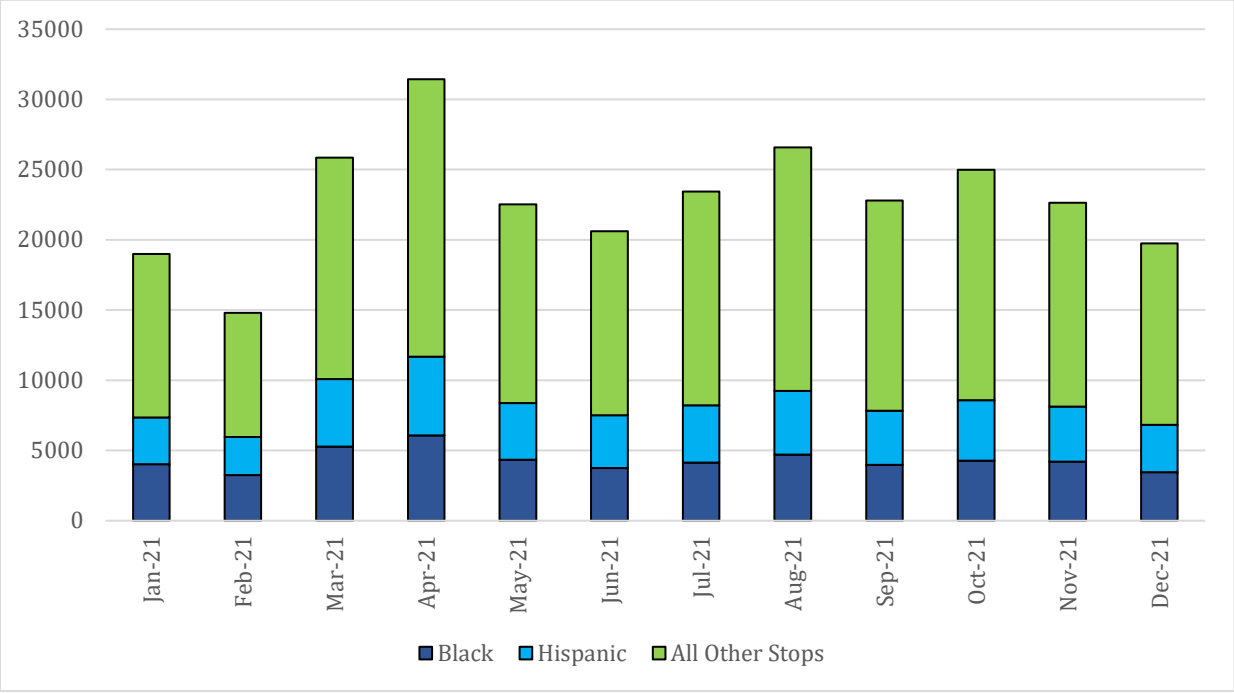


Figure 2.2 displays traffic stops by time of day for the entire analysis period. As can be seen from the figure, the total volume of traffic stops fluctuates significantly across different times of the day. The highest hourly volume of traffic stops in the sample occurred from five to six in the evening and

accounted for 7.5% of all stops. It is not surprising that the volume of traffic stops increases between these hours as this is a peak commuting time in Connecticut. The lowest volume of traffic stops occurred between four and five in the morning and continued at a suppressed level during the morning commute. The low level of traffic stops during the morning commute is likely due to an interest in maintaining a smooth flow of traffic during these hours. Discretionary traffic stops might be less likely to be made during these hours relative to others in the sample.

The evening commute represents a period when a significant proportion of traffic stops are made. The surge seen between the hours of four and seven at night represents the most significant period of traffic enforcement. In aggregate, stops occurring between these hours represented 20% of total stops. Interestingly, there seems to be a significant correlation between the proportion of minority stops and the overall volume of stops. In particular, the share of Hispanic and Black stops increases when the total volume of stops decreases.

Figure 2.2: Aggregate Traffic Stops by Time of Day

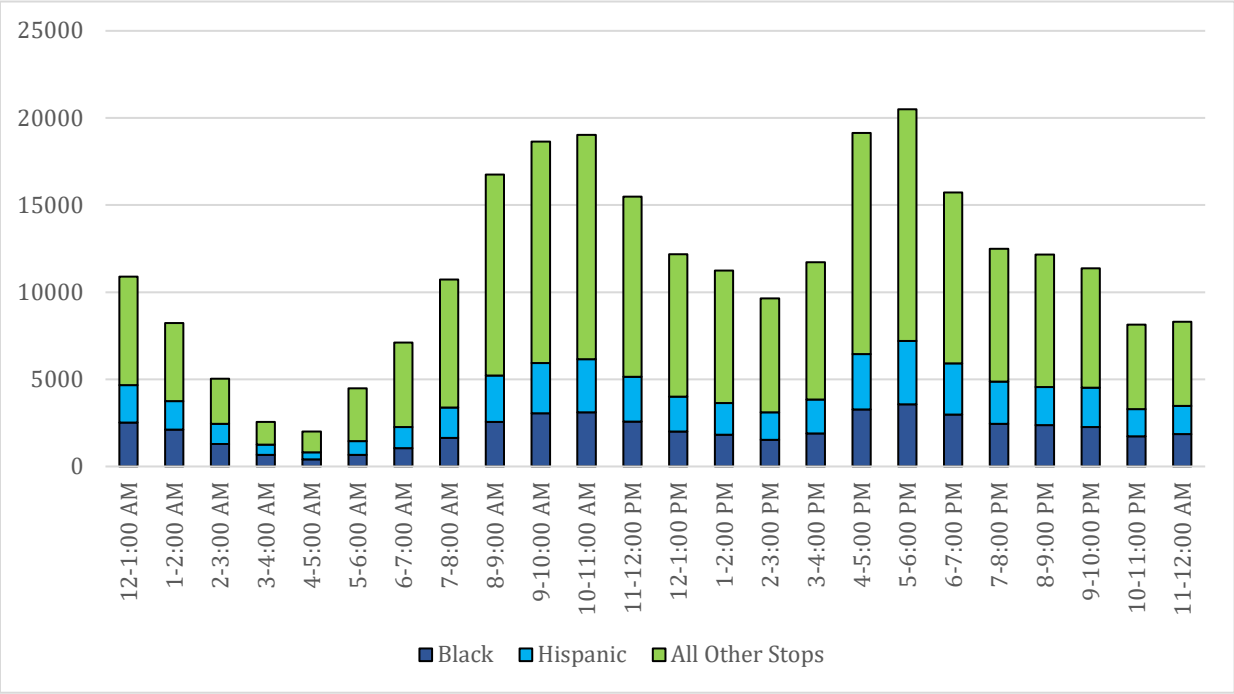
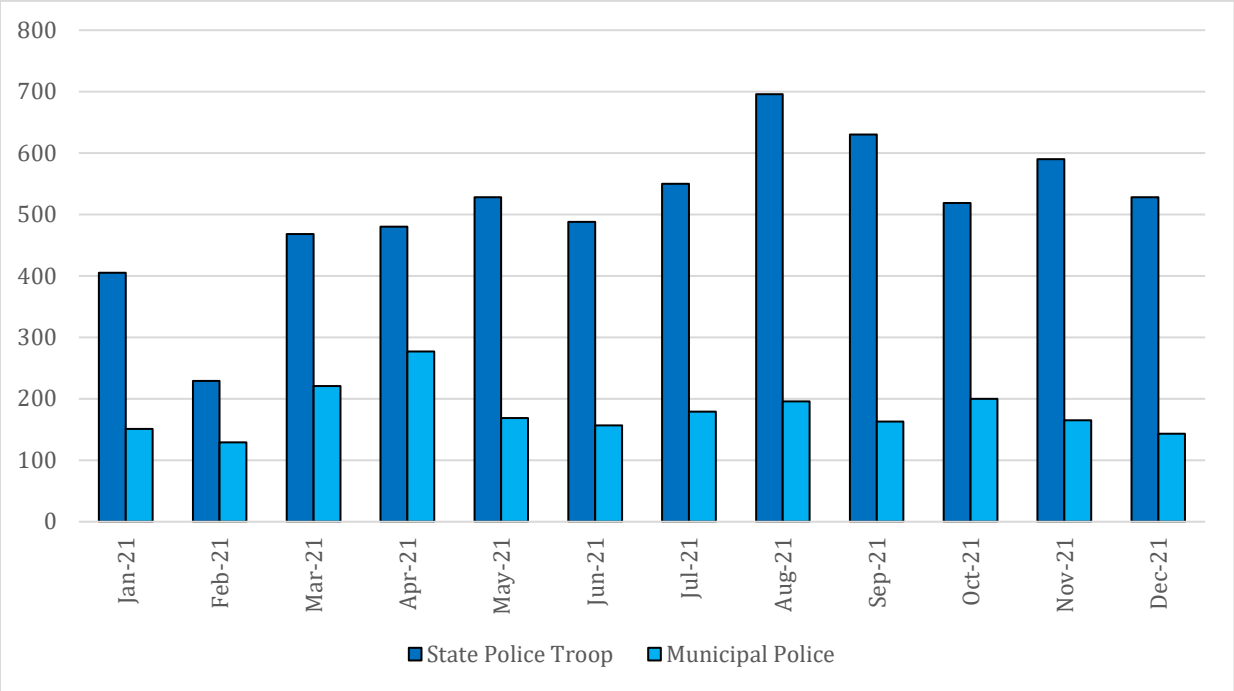


Figure 2.3 illustrates the average number of traffic stops by month for municipal police agencies and the state police. The data illustrates a fairly stable pattern of municipal traffic stop enforcement with the average number of traffic stops ranging from 129 to 277 each month for each agency. State police traffic stops are less stable by month relative to the municipal departments and range from a low of 229 to a high of 696. This may be due to the nature of state police traffic enforcement activity that fluctuates for a variety of reasons including enforcement campaigns around the holidays.

Figure 2.3: Average Number of Traffic Stops by Month for Police Agencies



The level of and reason for traffic stop enforcement varies greatly across agencies throughout the state for a number of reasons. For example, some enforcement is targeted to prevent traffic crashes in dangerous areas, combat increased criminal activity, or respond to complaints from citizens. Those agencies with active traffic units tend to produce a higher volume of traffic stops. The rate of traffic stops per 1,000 residents in the population helps to compare the stop activity between agencies. The five municipal police agencies with the highest stop rate per 1,000 residents are Windsor, Orange, Simsbury, Waterford, and Wilton. Conversely, Shelton, Granby, Portland, Weston, and Stratford have the lowest rate of stops per 1,000 residents. Table 2.1 shows the distribution of stops for the highest and lowest level of enforcement per 1,000 residents for police agencies. All department results are contained in the Table B.1 of Appendix B.

Table 2. 1: Municipal Police, Highest and Lowest Rates of Traffic Stops

Town Name	16+ Population*	Traffic Stops	Stops per 1,000 Residents
Connecticut	2,825,946	274,432	97
Municipal Departments with the Highest Rate of Traffic Stops			
Windsor	23,222	10,704	461
Orange	11,017	3,212	292
Simsbury	17,773	5,174	291
Waterford	15,760	4,587	291
Wilton	12,973	3,759	290
Municipal Departments with the Lowest Rate of Traffic Stops			
Shelton	32,010	56	2
Granby	8,716	54	6
Portland	7,480	78	10
Weston	7,255	83	11
Stratford	40,980	655	16

* The population 16 years of age and older was obtained from the United States Census Bureau 2010 Decennial Census.

Table 2.2 presents some basic demographic data on persons stopped in Connecticut between January 1, 2021 and December 31, 2021. Nearly two-thirds (62%) of drivers stopped were male and the vast majority of drivers (88%) were Connecticut residents. Of the stops conducted by police departments other than state police, 91% were Connecticut residents. Of the stops made by state police, 79% were Connecticut residents. About one-third (37%) of drivers stopped were under the age of 30 compared to 24% over 50. The vast majority of stops in Connecticut were White Non-Hispanic drivers (61%); 19% were Black Non-Hispanic drivers; 18% were Hispanic drivers; and 3% were Asian/Pacific Islander Non-Hispanic and American Indian/Alaskan Native Non-Hispanic drivers.

Table 2. 2: Statewide Driver Characteristics

Race and Ethnicity		Gender		Residency		Age	
White	60.7%	Male	62.5%	CT Resident	88.0%	16 to 20	9.6%
						21 to 30	27.7%
Black	18.7%					31 to 40	22.2%
						41 to 50	15.9%
Hispanic	17.6%	Female	37.5%	Non-Resident	12.0%	51 to 60	13.7%
						Older than 61	10.8%
Other	3.0%						

Table 2.3 presents data on the characteristics of the traffic stops in the state. Most traffic stops were made for a violation of the motor vehicle laws (91%) as opposed to a stop made for an investigatory purpose or equipment violation. The most common violation drivers were stopped for was speeding (36%). After a driver was stopped, over 30% were given a ticket while most of the remaining drivers received some kind of a warning (61%). Statewide, about 1 percent of traffic stops resulted in the arrest of a driver and less than 2.5 percent of stops resulted in a search being conducted.

Table 2. 3: Statewide Stop Characteristics

Classification of Stop		Basis for Stop	
Motor Vehicle Violation	90.6%	Speeding	36.5%
Equipment Violation	7.1%	Defective Lights	6.5%
Investigatory	2.3%	Misc. Moving Violation	7.5%
Outcome of Stop		Stop Sign	9.8%
Uniform Arrest Report	1.1%	Registration	6.9%
Misdemeanor Summons	6.0%	Traffic Control Signal	7.2%
Infraction Ticket	30.5%	Cell Phone	8.3%
Written Warning	18.4%	STC Violation	4.2%
Verbal Warning	42.6%	Display of Plates	2.7%
No Disposition	1.4%	Seatbelt	2.0%
Vehicles Searched	2.4%	All Other	8.4%

In addition to the difference in the volume of traffic stops across communities, agencies stopped drivers for a number of different reasons. Police record the statutory reason for stopping a motor vehicle for every stop. Those statutes are then sorted into 15 categories from speeding to registration violation to stop sign violation. For example, all statutory violations that are speed related are categorized as speeding. Although speeding is the most often cited reason for stopping a motor vehicle statewide, the results vary by jurisdiction.

The average municipal police department stops for speeding violations was 35% compared to the state police average of 41%. Due to the nature of state police highway operations, it is reasonable that its average for speeding is higher. In 19 departments more than 50% of the traffic stops were for speeding violations. On the other hand, four departments stopped drivers for speeding less than 5% of the time. These four departments were all special police agencies and they have limited jurisdiction and it is reasonable that they are not stopping a high percentage of drivers for speeding violations. Table 2.4 shows the top 10 departments where speeding (as a percentage of all stops) was the most common reason for the traffic stop. All department results are contained in the Table B.2 of Appendix B.

Table 2. 4: Highest Speeding Stop Rates across All Departments

Department Name	Total Stops	Speeding Violations
Simsbury	5,174	73.6%
Wolcott	340	69.4%
Ledyard	2,825	68.7%
Redding	507	67.7%
Thomaston	483	65.8%
New Milford	1,443	65.3%
Easton	373	62.5%

Department Name	Total Stops	Speeding Violations
Suffield	644	61.0%
Windsor	10,704	60.5%
Southington	3,592	60.2%

Registration violations have been cited as a low discretion reason for stopping a motor vehicle, particularly due to the increased use of license plate readers to detect registration violations. Statewide, 7% of all traffic stops are for a registration violation. Table 2.5 presents the top 10 departments with the highest percentage of stops for registration violations. All department results are contained in the Table B.2 of Appendix B.

Table 2. 5: Highest Registration Violation Rates across All Departments

Department Name	Total Stops	Registration Violations
Troop B	2,353	21.6%
Farmington	3,161	19.0%
Woodbridge	845	17.6%
Bristol	1,590	16.6%
Willimantic	693	16.0%
North Branford	523	15.9%
West Haven	2,152	15.5%
Troop A	8,356	15.3%
Waterbury	2,611	14.2%
Old Saybrook	1,468	13.6%

The Connecticut Department of Transportation and the National Highway Safety Administration work together every year to fund a variety of different driver safety campaigns. Some of the campaigns that we are most familiar with include: “Click it or Ticket,” “Drive Sober or get Pulled Over,” and “Move Over.” Each year law enforcement agencies receive federal grants to fund targeted traffic safety campaigns. This past year, Connecticut continued to see a significant number of traffic stops for distracted driving. Stops as the result of a cell phone violation are the third most common reason for stopping a driver. Statewide, 8% of all stops were the result of a cell phone violation and this rate varies across departments. Table 2.6 presents the top 10 departments with the highest percentage of stops for cell phone violations. All department results are contained in the Table B.2 of Appendix B.

Table 2. 6: Highest Cell Phone Violation Rates across All Departments

Department Name	Total Stops	Cell Phone Violations
Hamden	1,411	51.5%
Middletown	1,350	39.7%
Brookfield	392	39.0%
West Hartford	2,388	27.9%
Danbury	3,027	27.0%
Plymouth	1,664	26.2%
State Capitol Police	4	25.0%
Canton	891	24.6%
Woodbridge	845	23.4%
Glastonbury	1,829	22.4%

Some Connecticut residents have expressed concern about the stops made for violations that are perceived as more discretionary in nature; therefore, potentially making the driver more susceptible to possible police bias. Those stops are typically referred to as pretext stops and might include stops for defective lights, excessive window tint, or a display of plate violation each of which, though a possible violation of state law, leaves the police officer with considerable discretion with respect to actually making the stop. A statewide combined average for stopping drivers for any of these violations is 11%. Forty-two municipal police departments and two special police agencies exceeded that statewide average. Table 2.7 presents the top 10 departments with the highest percentage of stops for equipment-related violations. All department results are contained in the Table B.2 of Appendix B.

In communities with a larger proportion of stops due to these violations, it is recommended that the departments be proactive in discussing the reasons for these stops with members of the community and examine for themselves whether or not such stops produce disparate enforcement patterns.

Table 2. 7: Highest Equipment-Related Violation Rates across All Departments

Department Name	Total Stops	Equipment-Related Violations
Plainfield	1,406	41.9%
Middlebury	629	29.4%
Putnam	520	27.9%
Torrington	5,441	27.7%
Orange	3,212	27.1%
East Windsor	1,290	26.4%
Department of Motor Vehicle	1,276	25.9%
Plymouth	1,664	25.4%
Groton City	1,240	23.7%
Derby	429	21.9%

Many have argued that it is difficult for police to determine the defining characteristics about a driver prior to stopping and approaching the vehicle. Similar to variations found across departments for the reason for the traffic stop, there are variations that occur with the outcome of the stop. These variations illustrate the influence that local police departments have on the enforcement of state traffic laws. Some communities may view infraction tickets as the best method to increase traffic safety, while others may consider warnings to be more effective. This analysis should help police departments and local communities understand their level and type of traffic enforcement when compared to other communities.

Approximately one-third (30%) of drivers stopped in Connecticut received an infraction ticket, while 60% received either a written or verbal warning. Individual jurisdictions varied in their post-stop enforcement actions. Danbury issued infraction tickets in 67% of all traffic stops, which is one of the highest in the state. Portland only issued infraction tickets in 1% of all traffic stops, which is the lowest rate in the state. For state police, officers not assigned to a troop issued the highest infractions (83%) and Troop C issued the lowest number of infractions (23%). Table 2.8 presents the highest infraction rates across all departments. All department results are contained in the Table B.3 of Appendix B.

Table 2. 8: Highest Infraction Rates across All Departments

Department Name	Total Stops	Infraction Ticket
Highest Municipal Departments		
Danbury	3,027	67.5%
Hamden	1,411	60.6%
Hartford	12,020	58.1%
Stamford	3,630	57.6%
East Hartford	5,065	55.8%
New Haven	7,387	53.6%
Meriden	2,956	51.3%
Waterbury	2,611	50.8%
New London	1,428	42.9%
Woodbridge	845	42.5%
Highest State Police Troops		
CSP Headquarters	9,839	83.4%
Troop D	5,552	54.0%
Troop H	3,668	52.7%
Troop I	3,919	49.4%
Troop G	7,227	45.2%

On the other hand, Weston issued warnings 98% of the time (the highest rate) and East Hartford issued warnings 28% of the time (the lowest rate). For state police, Troop C issued the highest percentage of warnings (67%) and the group of officers not assigned to a troop issued the lowest percentage of warnings (14%). Table 2.9 presents the highest warning rates across all departments. All department results are contained in the Table B.3 of Appendix B.

Table 2. 9: Highest Warning Rates across All Departments

Department Name	Total Stops	Resulted in Warning
Highest Municipal Departments		
Weston	83	97.6%
Portland	78	96.2%
Windsor	10,704	94.6%
Simsbury	5,174	93.5%
Middlebury	629	93.5%
Thomaston	483	91.9%
Suffield	644	91.8%
Putnam	520	90.8%
Guilford	639	90.0%
Ridgefield	839	89.9%
Highest State Police Troops		
Troop C	8,516	67.0%
Troop B	2,353	61.8%
Troop F	8,277	61.0%
Troop A	8,356	57.1%
Troop K	5,165	56.7%

Statewide, only 1% of all traffic stops resulted in the driver being arrested. As with infraction tickets and warnings, municipal departments varied in the percentage of arrests associated with traffic

stops. Troop H issued the most uniform arrest reports from a traffic stop, with 9.1% of all stops resulting in an arrest. Only six municipal police departments and one state police troop arrested more than 3% of all drivers stopped. Table 2.10 presents the highest arrest rates across all departments. All department results are contained in the Table B.3 of Appendix B.

Table 2. 10: Highest Arrest Rates across All Departments

Department Name	Total Stops	Arrests
Troop H	3,668	9.1%
Bridgeport	1,959	5.0%
Seymour	1,963	4.4%
Groton City	1,240	4.3%
Naugatuck	3,255	4.2%
New London	1,428	3.9%
Willimantic	693	3.3%
Plymouth	1,664	2.9%
Groton Town	2,348	2.8%
Yale University	41	2.4%

Rarely do traffic stops in Connecticut result in a vehicle being searched. During the study period, only 2.4% of all traffic stops resulted in a search. Although searches are rare in Connecticut, they do vary across jurisdictions and the data provides information about enforcement activity throughout the state. When they search a vehicle, officers must report the supporting legal authority, and whether contraband was found. Thirty-Four departments exceeded the statewide average for searches, but the largest disparity was found in Naugatuck (19%), Watertown (14%), Waterbury (13%), Stratford (11%), and Bridgeport (10%). Of the remaining departments, 8 searched vehicles more than 5% of the time, 18 searched vehicles between 2.4% and 5% of the time, and the remaining departments searched vehicles less than 2.4% of the time. Only Troop H exceeded the statewide average for stops resulting in a search. Table 2.11 presents the highest search rates across all municipal departments. All department results are contained in the Table B.4 of Appendix B.

Table 2.11: Highest Searches Rates across All Departments

Department Name	Total Stops	Resulted in Search
Highest Municipal Departments		
Naugatuck	3,255	18.7%
Watertown	779	13.9%
Waterbury	2,611	13.4%
Stratford	655	11.0%
Bridgeport	1,959	10.0%
Groton City	1,240	8.5%
New Britain	3,602	8.5%
Norwich	2,325	7.1%
Newington	1,839	6.9%
Seymour	1,963	6.5%

III: ANALYSIS OF TRAFFIC STOPS, VEIL OF DARKNESS

The Veil of Darkness analysis relies on seasonal variation in the timing off sunset to test for evidence of racial and ethnic disparities in police traffic stops. The test operates under the key assumption that police officers are marginally better able to observe the race and ethnicity of motorists during daylight relative to darkness (Grogger and Ridgeway 2006; Ridgeway 2009; Horace and Rohlin 2018; Kalinowski et al. 2017, 2019a, 2019b).[4] The test relies on seasonal variation in the timing of sunset as well as the discrete daylight savings time shift to compare stops made at the same time in darkness versus daylight. The advantage of this methodology, relative to population-based benchmarks, is that it does not require any assumptions about the underlying risk-set of motorists on the roadway. Rather, the test presumes that the composition of motorists does not vary in response to changes to visibility.[5] Within a fixed window when the timing of sunset varies throughout the year, the racial composition of stops in darkness is used as a counterfactual for stops in daylight, i.e. when officers can better observe the race of the motorist.

More specifically, the Veil of Darkness test evaluates whether statistically significant disparities exist in the likelihood that a stopped motorist is a minority during daylight relative to darkness. As detailed explicitly in Appendix A.2, Grogger and Ridgeway (2006) illustrate that under certain conditions the odds-ratio of a stopped motorist being a minority in daylight vs. darkness is equivalent to the odds-ratio that a minority motorist is stopped during daylight vs. darkness. In a practical context, these assumptions are that variation in travel and enforcement patterns (abject of discrimination) do not change differentially by race in response to daylight. To ensure that these conditions are met, the estimates condition on time and day of the week. To further control for inherent differences in daylight and darkness, the sample is restricted to the inter-twilight window, a period of time during the day when solar visibility varies throughout the year (i.e. between the earliest eastern sunset and the latest western end to civil twilight). Conveniently, this window of time falls within the evening commute where we might expect the risk-set of motorists to be less susceptible to seasonal variation.

III.A: AGGREGATE ANALYSIS WITH VEIL OF DARKNESS, 2021 AND 2019-21

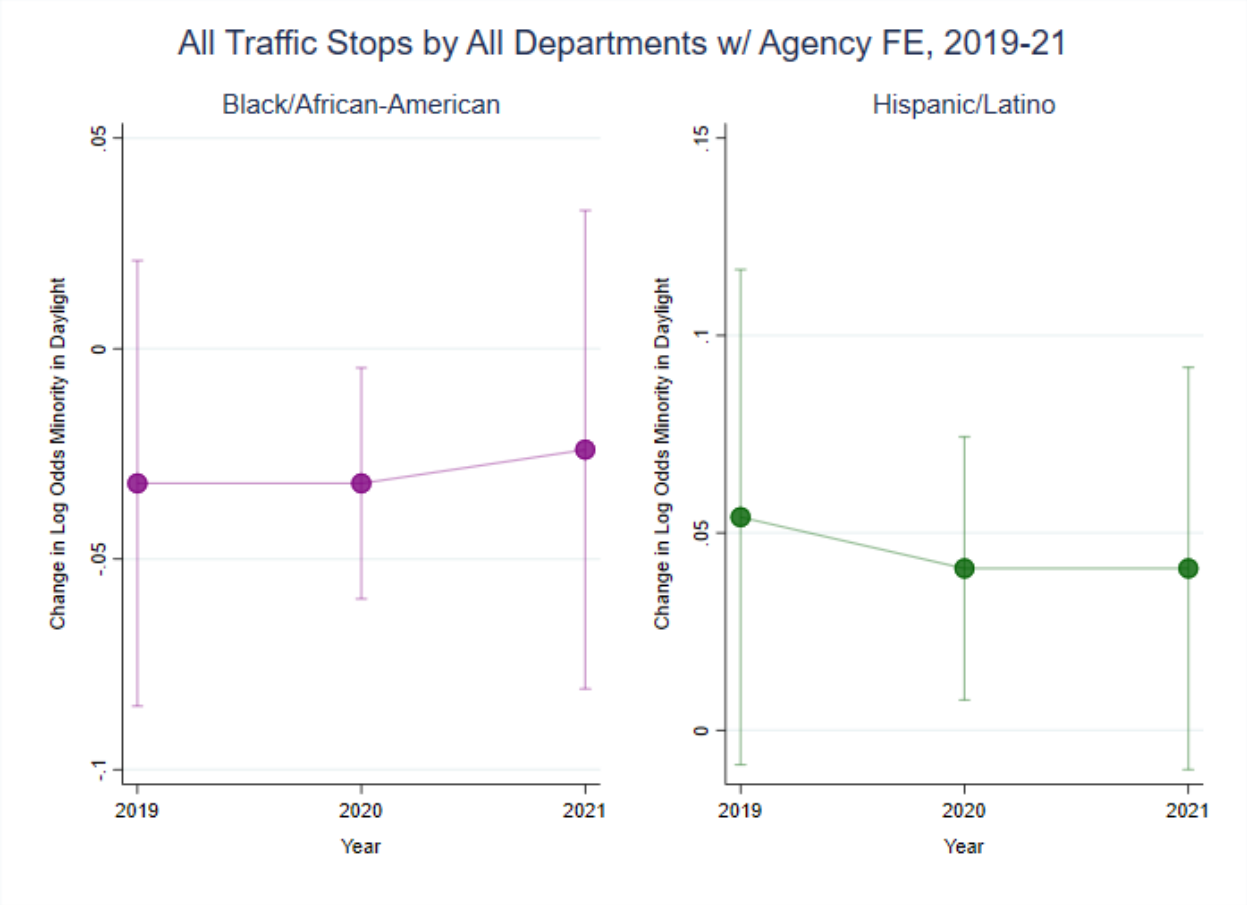
Figure 3.1 presents the results from applying the veil of darkness test to the aggregate sample of traffic stops made within the inter-twilight sample in Connecticut in 2019, 2020, and 2021. The vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight and includes controls for time of day, day of week, and department. The figure plots the estimated change in the odds that a Black (left panel) or Hispanic (right panel) motorist is stopped in daylight relative to darkness. Under the assumptions of this test, an increase in the odds that a minority motorist is represented in the traffic stop data during

[4] Applications of the so-called "Veil of Darkness" method include: Grogger and Ridgeway (2006) in Oakland, CA; Ridgeway (2009) in Cincinnati, OH; Ritter and Bael (2009) and Ritter (2017) in Minneapolis, MN; Worden et al. (2010; 2012) in Syracuse, NY while Horace and Rohlin (2016) in Syracuse, NY; Renauer et al. (2009) in Portland, OR; Taniguchi et al. (2016a, 2016b, 2016c, 2016d) in Durham, Greensboro, Raleigh, and Fayetteville; Masher (2016) in New Orleans, LA; Chanin et al. (2016) in San Diego, CA; Ross et al. (2015; 2016; 2017a; 2017b) in Connecticut and Connecticut; Criminal Justice Policy Research Institute (2017) in Corvallis PD, OR; Milyo (2017) in Columbia, MO; Smith et al. (2017) in San Jose, CA; and Wallace et al. (2017) in Maricopa, AZ.

[5] Note that this assumption allows for differential rates of traffic stops to exist across races and the potential for differences in guilt and driving behavior.

daylight is suggestive of potential adverse treatment on the part of police. Across the period 2019-21, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 19.14% and 16.74% respectively as compared to 60.88% non-Hispanic Caucasian. Exponentiating the coefficients from below, we find that the annual estimated change in the odds a Black or Hispanic motorist is stopped in daylight relative to darkness ranged from 0.97 to 0.98 and 1.04 to 1.06 respectively. According to this test, Hispanic motorists were more likely to be stopped by Connecticut police during daylight relative to darkness, but the difference was estimated with very little statistical precision. Black motorists were marginally less likely to be stopped but the difference was also statistically insignificant.

Figure 3.1: Aggregate VOD Analysis by Year, All Traffic Stops 2019-21



Notes: Coefficient estimates are obtained from Table 3.1 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.1 presents the comprehensive set of results from the 2021 veil of darkness test applied to the aggregate sample of traffic stops made by all Connecticut police departments within the inter-twilight window. The results were obtained by estimating Equation 4 of Appendix A.2 with the standard errors clustered by department. The estimates include controls for the hour, day of week, and department. The estimates rely on four minority definitions which are not mutually exclusive, e.g. the first specification includes all non-Caucasian motorists (regardless of ethnicity) while the third includes all Hispanic motorists (regardless of race). The second specification is restricted to only Black motorists (regardless of ethnicity, i.e. a subset of the first specification) and the fourth

specification which includes both Black and Hispanic motorists (i.e. combines the second and third specifications). The omitted control group across all specifications include only stops made of motorists who were observed to be Caucasian and non-Hispanics. Note that the results for the Black and Hispanic alone categories are also portrayed graphically in Figure 3.1.

The coefficient estimates across all categories in Table 3.1 are relatively inconsistent in terms of sign and statistical significance across specifications. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes to the odds for stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the odds that a minority motorist is stopped during daylight is indicative of discrimination under the premise that all else is held fixed and the only thing changing is the officer's ability to perceive race. In the aggregate, the results below suggest that Hispanic motorists were more likely to be stopped by police during daylight when their race is more easily observed. However, this difference was statistically indistinguishable from zero. Black motorists were found to be marginally less likely to be stopped by police during daylight in 2021 but the difference was also statistically indistinguishable from zero. Note that these estimates represent an aggregate statewide estimate across all departments and State Police troops in the state.

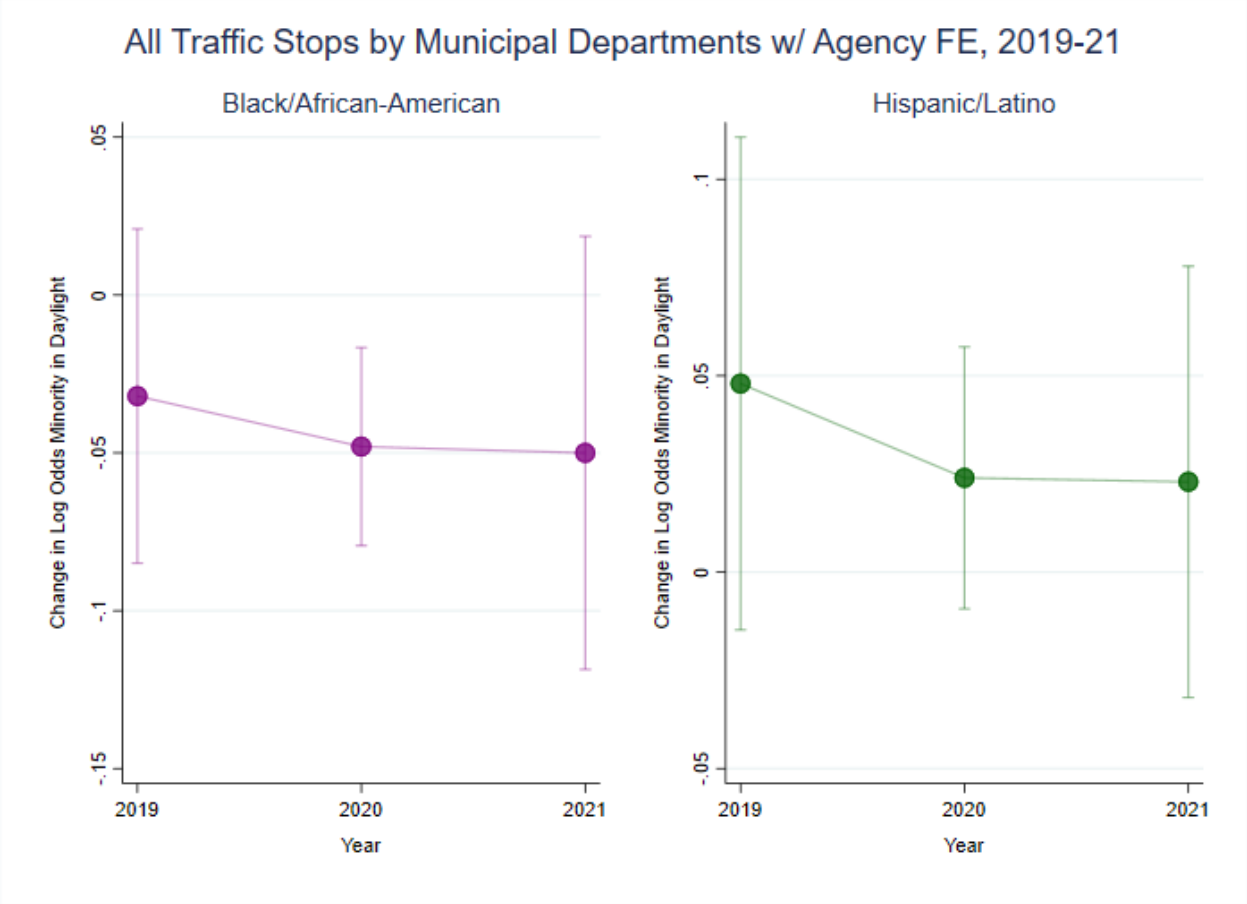
Table 3.1: Logistic Regression of Race/Ethnicity on Daylight with Department Fixed-Effects, All Traffic Stops 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.025	-0.024	0.041	0.006
	Standard Error	(0.028)	(0.029)	(0.026)	(0.020)
Sample Size		53,017	50,989	49,978	62,343
Pseudo R^2		0.145	0.172	0.123	0.143

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for time of the day, day of the week, analysis year, and department fixed-effects.
Note 3: Sample includes all traffic stops made during the inter-twilight window in 2021.

Figure 3.2 presents the results from the veil of darkness test applied to the combined sample of municipal departments from 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight and controls for time of day, day of week, and department. A positive coefficient represents an increase in the odds a minority motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2019-21, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 21.57% and 18.01% respectively as compared to 57.30% non-Hispanic Caucasian. Exponentiating the coefficient estimates from below, we find that the annual estimated change in the odds a Black motorist is stopped in daylight ranged from 0.95 to 0.97. The difference in the likelihood of being stopped was negative and statistically significant in 2020 which may or may not be indicative of a potential disparity. The change in the odds a Hispanic motorist is stopped in daylight relative to darkness ranged from 1.02 in to 1.05 and were statistically insignificant in every year.

Figure 3.2: Aggregate VOD Analysis by Year, Municipal Traffic Stops 2019-21



Notes: Coefficient estimates are obtained from Table 3.2 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.2 presents the full set of results estimated from the sample of all municipal police departments during the inter-twilight window in 2021. As discussed above with respect to Figure 3.2, we find very little evidence of a statistically significant disparity for minority motorists in the combined sample of municipal police departments with the exception of Black motorists but those results are largely inconclusive. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes to the odds for stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the odds that a minority motorist is stopped during daylight is typically considered to be indicative of discrimination. In the aggregate, the results below do not consistently show any disparity in terms of the likelihood that minority motorists are stopped by Connecticut municipal police during daylight relative to darkness.

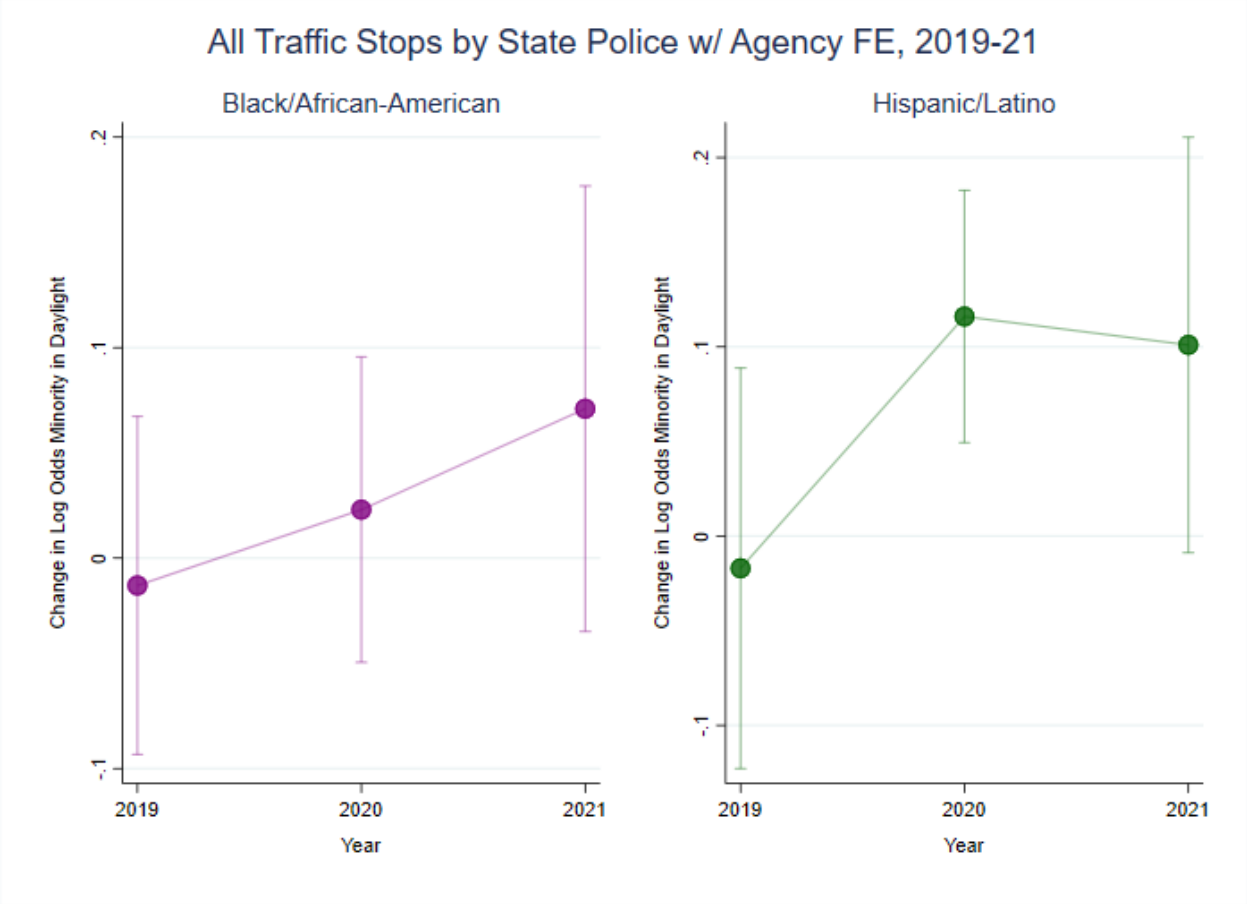
Table 3.2: Logistic Regression of Race/Ethnicity on Daylight, Municipal Traffic Stops 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.052	-0.050	0.023	-0.017
	Standard Error	(0.035)	(0.035)	(0.028)	(0.024)
Sample Size		38,864	37,431	36,364	46,548
Pseudo R^2		0.163	0.188	0.141	0.157

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for time of the day, day of the week, analysis year, and department fixed-effects.
Note 3: Sample includes all traffic stops made during the inter-twilight window in 2021.

Figure 3.3 presents the results from the veil of darkness test applied to the combined sample of State Police departments from 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight and controls for time of day, day of week, and department. A positive coefficient represents an increase in the odds a minority motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2019-21, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 12.69% and 13.36% respectively as compared to 70.39% non-Hispanic Caucasian. Exponentiating the coefficient estimates from below, we find that the annual estimated change in the odds a Black motorist is stopped in daylight ranged from 0.99 to 1.07 from 2019-21. The change in the odds a Hispanic motorist is stopped in daylight relative to darkness ranged from 0.98 to 1.12 from 2019-21. The difference in the likelihood of being stopped was statistically indistinguishable from zero for Black motorists in every year and significant for Hispanic motorists in 2020 and 2021.

Figure 3.3: Aggregate VOD Analysis by Year, State Police Traffic Stops 2019-21



Notes: Coefficient estimates are obtained from Table 3.3 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.3 presents the full set of results estimated from the sample of all State Police departments during the inter-twilight window in 2021. As discussed above with respect to Figure 3.3, we find evidence of a statistically significant disparity against Hispanic motorists in 2021 for the combined sample of Connecticut State Police. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct correspondence between changes to the odds for stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the odds that a minority motorist is stopped during daylight is indicative of discrimination. In the aggregate, the results below show a disparity in terms of the likelihood that a Hispanic or Black motorist is stopped by Connecticut State Police, but the coefficients were estimated with a low degree of statistical precision.

Table 3.3: Logistic Regression of Race/Ethnicity on Daylight, State Police Traffic Stops 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	0.067	0.071	0.101*	0.082*
	Standard Error	(0.050)	(0.054)	(0.056)	(0.045)
Sample Size		14,153	13,558	13,614	15,795
Pseudo R^2		0.057	0.065	0.039	0.054

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.
Note 2: All specifications include controls for time of the day, day of the week, analysis year, and department fixed-effects.
Note 3: Sample includes all traffic stops made during the inter-twilight window in 2021.

As mentioned, the prior set of results aggregate all traffic stops across multiple departments and should be considered an average treatment effect estimated from quasi-random variation in the timing of sunset. Although the results from this section indicated that there was not an overarching disparity in the rate of minority traffic stops, that does not necessarily indicate that all individual police departments are uniformly engaged in bias-free policing. Note also that the findings of this test pertain exclusively to the inter-twilight window and cannot be generalized to other times of the day when different officers might be on duty or different enforcement activities are taking place. To address the former, we analyze individual departments in a subsequent subsection while addressing the latter requires the use of additional analytical tests.

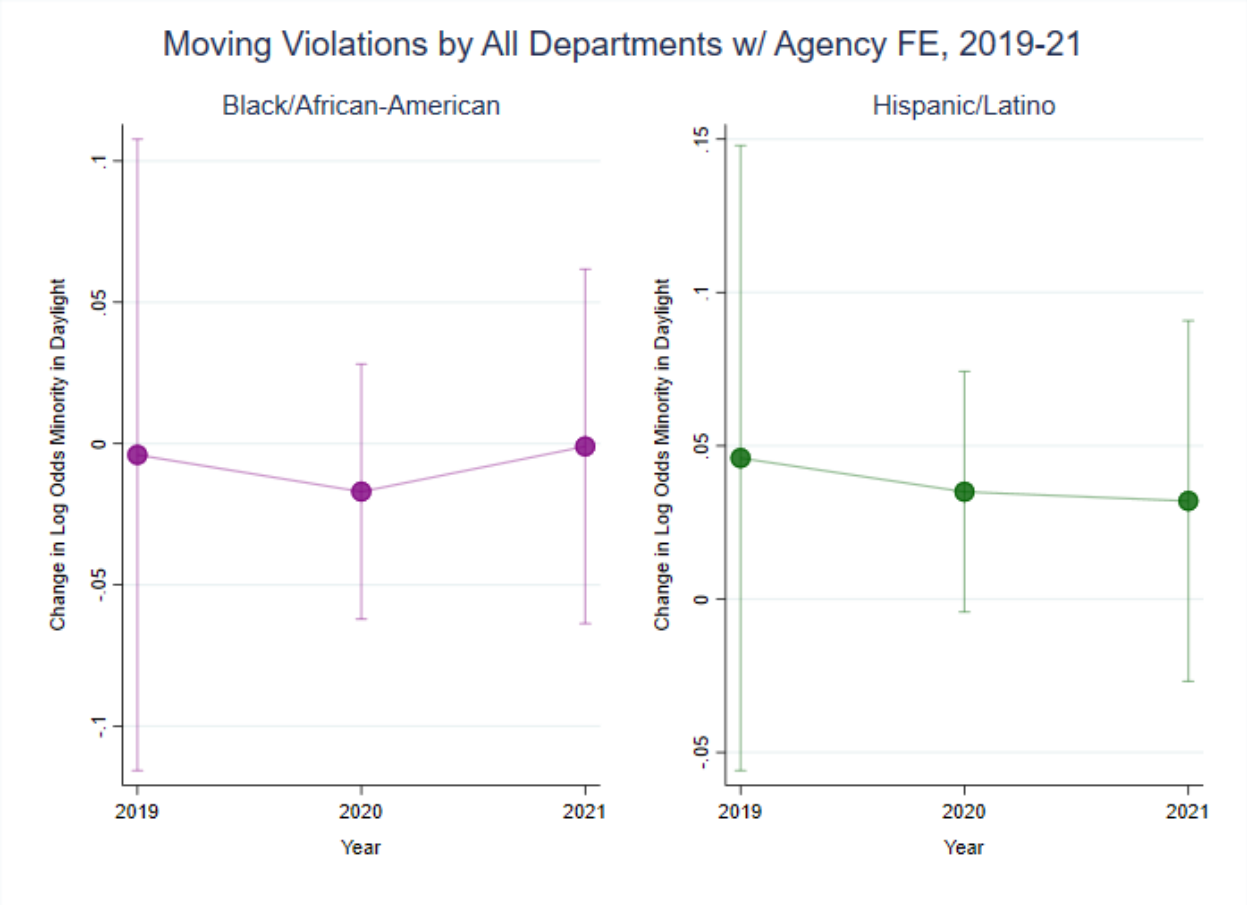
III.B: AGGREGATE ROBUSTNESS CHECKS WITH VEIL OF DARKNESS, 2021 AND 2019-21

This section presents a robustness check on the initial specification using a more restrictive subsample of only moving violations. As mentioned, an analysis using all violations is potentially biased against finding discrimination because specific types of violations are likely to be correlated with daylight/darkness and race/ethnicity. For example, imagine that minority motorists are more likely to have a broken headlight and that these violations are only observable and enforced by police during darkness. In that instance, comingling equipment violations with moving violations might make it likely that more minorities are stopped at night relative to a sample of only moving violations. Thus, these types of violations might have a large enough effect to bias the test statistic towards zero even in the presence of discrimination. In contrast, one might also imagine that cellphone and seatbelt violations have the potential to bias the results upward if they are only observable to police in daylight and also correlated with race/ethnicity. Since both scenarios seem reasonable and the net-effect of the two sources of bias is impossible to quantify, a natural robustness check on our initial findings is to simply limit the estimation sample to only moving violations.

Figure 3.4 presents the results from the veil of darkness test applied to the subsample of moving violation made by all policing agencies within the inter-twilight window from the last three annual reports in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient indicates an increase in the odds a minority motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2019-21,

the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 16.70% and 14.23% respectively as compared to 65.31% non-Hispanic Caucasian. Exponentiating the coefficient estimates from below, the annual estimated change in the odds a Black motorist is stopped in daylight ranged from 0.98 to 1.00 but was statistically insignificant in every year. The change in the odds a Hispanic motorist is stopped in daylight relative to darkness ranged from a factor of 1.03 to 1.05 but was statistically insignificant in every year. In the aggregate, the results below do not consistently show any disparity in terms of the likelihood that minority motorists are stopped by Connecticut police during daylight relative to darkness.

Figure 3.4: Aggregate VOD Analysis by Year, All Moving Violations 2019-21



Notes: Coefficient estimates are obtained from Table 3.4 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.4 presents the aggregate results estimated from the subsample of moving violations made by all departments during the inter-twilight window in 2021. As before, these results were estimated with the standard errors clustered by department and include controls for the hour, day of the week, and department. Relative to Table 3.1, the results are only marginally significant for Hispanic motorists with the additional sample restriction. In general, these results suggest that our prior set of results using the full sample were not driven by a correlation between race, visibility, and specific types of enforcement. In the aggregate, the results below do not show a disparity in terms of the likelihood that a minority motorist is stopped by Connecticut police in daylight relative to darkness.

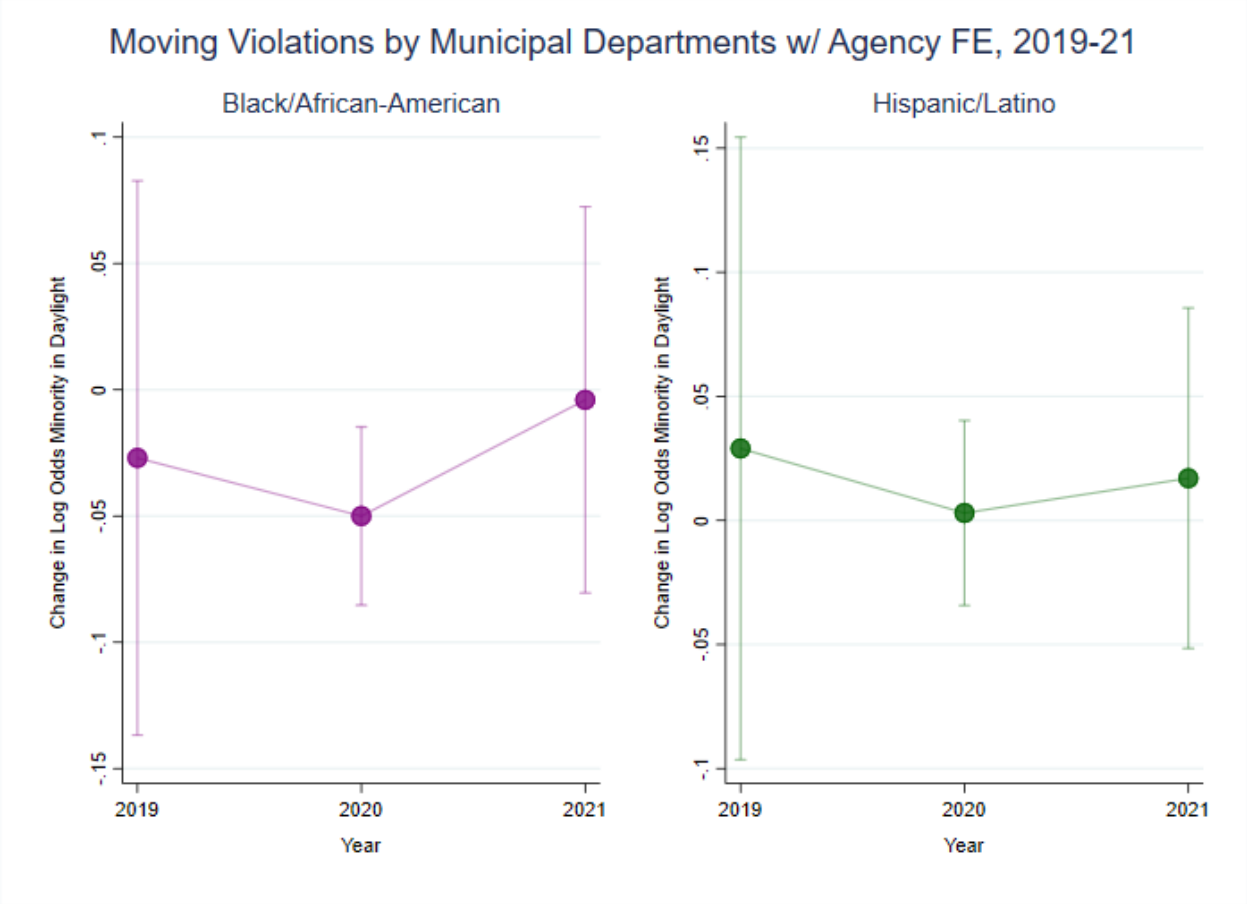
Table 3.4: Logistic Regression of Race/Ethnicity on Daylight with Department Fixed-Effects, All Moving Violations 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.004	-0.001	0.032	0.016
	Standard Error	(0.032)	(0.032)	(0.030)	(0.025)
Sample Size		33,778	32,309	31,462	38,183
Pseudo R^2		0.129	0.157	0.101	0.125

Notes: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. All specifications include controls for hour, day of the week, and department fixed effects. Sample includes all moving violations made during the inter-twilight window in 2021.

Figure 3.5 presents the results from the veil of darkness test applied to the subsample of moving violation made by municipal police departments within the inter-twilight window in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient indicates an increase in the odds a minority motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2019-21, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 18.58% and 15.15% respectively as compared to 62.64% non-Hispanic Caucasian. Exponentiating the coefficient estimates from below, we find that the annual estimated change in the odds a Black motorist is stopped in daylight ranged from 0.95 to 1 but these differences were statistically insignificant across all years except for 2020 where the coefficient was negative. The change in the odds a Hispanic motorist is stopped in daylight relative to darkness ranged from 1 to 1.03 but was statistically insignificant every year.

Figure 3.5: Aggregate VOD Analysis by Year, Municipal Moving Violations 2019-21



Notes: Coefficient estimates are obtained from Table 3.5 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.5 presents the aggregate results estimated from the subsample of moving violations made by municipal police departments during the inter-twilight window in 2021. As before, these results were estimated with the standard errors clustered by the department and include controls for the hour, day of the week, and department. Relative to Table 3.2, the results are mildly attenuate and statistically insignificant. These results below do not show a disparity in terms of the likelihood that a minority motorist is stopped by municipal police in daylight relative to darkness.

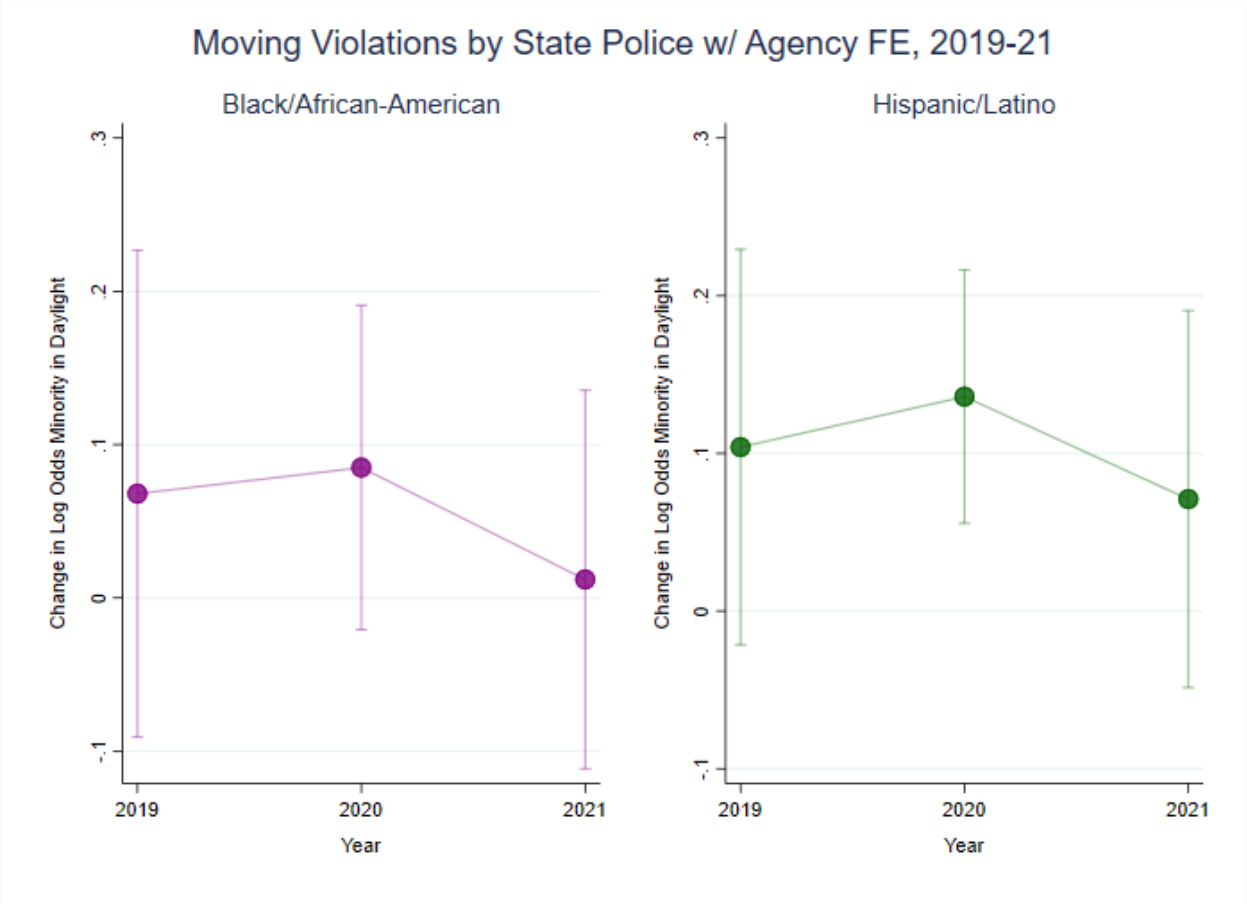
Table 3.5: Logistic Regression of Race/Ethnicity on Daylight, Municipal Moving Violations 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	-0.008	-0.004	0.017	0.008
	Standard Error	(0.039)	(0.039)	(0.035)	(0.028)
Sample Size		23,950	22,938	22,195	27,409
Pseudo R^2		0.155	0.185	0.122	0.146

Notes: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. All specifications include controls for hour, day of the week, and department fixed effects. Sample includes all moving violations made during the inter-twilight window in 2021.

Figure 3.6 presents the results from the veil of darkness test applied to the moving violation subsample of all State Police troops in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around the coefficient estimate of a logistic regression of motorist race/ethnicity on daylight as well as controls for time of day, day of week, and department. A positive coefficient indicates an increase in the odds a minority motorist was represented in the traffic stop data during daylight which is suggestive of potential adverse treatment on the part of police. Across the period 2019-21, the likelihood a stopped motorist was Black or Hispanic within the inter-twilight window averaged 18.58% and 15.15% respectively as compared to 62.64% non-Hispanic Caucasian. Exponentiating the coefficient estimates from below, we find that the annual estimated change in the odds a Black motorist is stopped in daylight ranged from 1.01 to 1.09. The change in the odds a Hispanic motorist is stopped in daylight relative to darkness ranged from 1.07 to 1.15 but was only statistically significant in 2020. In the aggregate, the results below do not consistently show any disparity in terms of the likelihood that minority motorists are stopped by Connecticut State Police during daylight relative to darkness.

Figure 3.6: Aggregate VOD Analysis by Year, State Police Moving Violations 2019-21



Notes: Coefficient estimates are obtained from Table 3.6 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 3.6 presents the results from the subsample of moving violations made by State Police during the inter-twilight window in 2021. As discussed above with respect to Figure 3.6, we find evidence of a statistically significant disparity for all minority groupings considered. Under the identifying assumptions of this test, see Appendix A.2, we should expect that there will be a direct

correspondence between changes to the odds for stopped motorists and that of motorists at risk of being stopped. Thus, a positive change in the odds that a minority motorist is stopped during daylight is indicative of discrimination. In the aggregate, the results below do not show a disparity in terms of the likelihood that a minority motorist is stopped by Connecticut state police in daylight relative to darkness

Table 3.6: Logistic Regression of Race/Ethnicity on Daylight, State Police Moving Violations 2021

LHS: Minority Status		Non-Caucasian	Black	Hispanic	Black or Hispanic
Daylight	Coefficient	0.010	0.012	0.071	0.034
	Standard Error	(0.057)	(0.063)	(0.061)	(0.050)
Sample Size		9,828	9,371	9,267	10,774
Pseudo R^2		0.050	0.059	0.032	0.046

Notes: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance rate greater than 10% All specifications include controls for hour, day of the week, and department fixed effects. Sample includes all moving violations made during the inter-twilight window in 2021.

The results presented in this robustness analysis provide additional evidence that there are not any overarching disparities in the rate at which police stop Black and Hispanic motorists in 2021. Although restricting the sample to moving violations slightly attenuated the point estimates and further reduced statistical power, across most of the models, we found that the results were consistent with those in the full sample, i.e. no evidence of disparity. As mentioned previously, these aggregate results are not necessarily representative of all individual policing agencies or officers within the state and should only be interpreted as an average effect. In the preceding section, the test will be applied to both individual municipal departments and State Police troops. It bears mentioning that these aggregate results are not necessarily representative of all individual policing agencies or officers within the state and should only be interpreted as an average estimate. In the preceding section, the test will be applied to both individual municipal departments and State Police troops.

III.C: DEPARTMENT ANALYSIS WITH VEIL OF DARKNESS, 2021 AND 2019-21

The analysis presented at the state-level shows that the odds a stopped motorist is a minority increases in daylight relative to darkness. As noted in the introduction and detailed in Appendix A.2, we can directly attribute this disparity to a change in the odds that a minority motorist is stopped in daylight relative to darkness under reasonable assumptions about the counterfactual. By construction, the aggregate analysis from Section III.A and III.B does not investigate the source of these disparities in terms of specific municipal police departments or State Police troops. The analysis presented in this section seeks to better identify the sources of that disparity in terms of specific departments and troops by running separate tests for each jurisdiction.

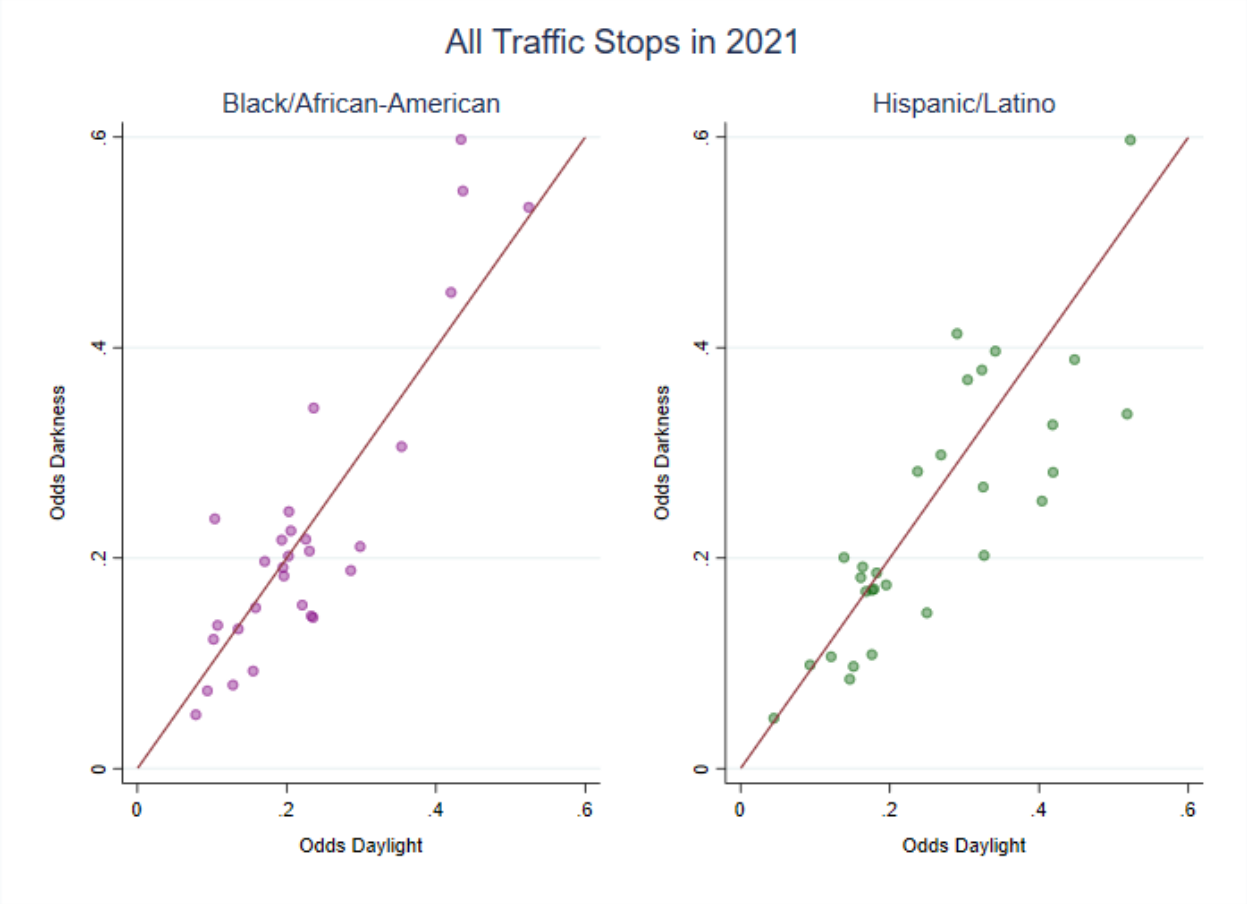
In this section, we graphically present estimate of the veil of darkness test (i.e. Equation 4 of Appendix A.2) separately for each municipal department and State Police troop. We first provide results for the 2021 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2019-21 and graphically present estimates of the effect of daylight for smaller departments which previously had an insufficiently small sample to run the test annually. Although restricting the sample of stops to the inter-twilight window is necessary to mitigate the risk

of violating the identifying assumptions of the veil of darkness test, it is a relatively onerous sample restriction and significantly reduces the estimation power in small samples. In the figures and discussion below, we highlight only the departments found to have a statistically significant disparity in the Black or Hispanic alone categories for either the 2021 or combined 2019-21 samples. The full results can be found in Table C.7 and C.9 of Appendix C. For both sets of estimates, we calculate robust standard errors and include a vector of controls for hour and day of the week. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either of the Hispanic or Black alone minority groups. Further, we only highlight departments that withstand the scrutiny of restricting the sample to only moving violations and that have a false discovery rate below 10% in both specifications. We provide the full set of results in Tables C.1 and C.3 and the moving violation robustness tests in C.2 and C.4 of Appendix C.

Figure 3.7 plots the odds a Black (left panel) or Hispanic (right panel) motorist is stopped relative to a non-Hispanic Caucasian motorist in daylight versus darkness by town in 2020. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the odds a stopped motorist is a minority in darkness and the horizontal axis plots the same odds in daylight. For ease of presentation in the figure, we approximate the regression results by imposing the coefficient estimate of daylight from Table C.8 of Appendix C on the unadjusted odds a minority motorist is stopped in darkness during the inter-twilight window.[6] The red 45-degree line represents parity (equal treatment) between daylight and darkness amongst minorities and non-Hispanic Caucasians. Thus, only departments falling below this line (bottom right quadrant) are more likely to stop minority motorists during daylight when their race is more easily observed. Ordinarily, we annotate those departments where the difference is statistically significant at or above the 95% confidence level in the overall sample of traffic stops as well as the robustness test using only moving violations. However, we do not identify any departments in 2021 as having a statistically significant disparity in the rate that Black or Hispanic motorists are stopped by their officers. It is worth noting that Hartford sporadically appeared across several of the robustness checks but not consistently enough to draw a conclusion.

[6] More specifically, the odds of a minority stop in darkness is the uncontrolled raw level rather than the regression adjusted level. We do this for simplicity and ease of exposition.

Figure 3.7: Veil of Darkness Analysis, All Departments 2021



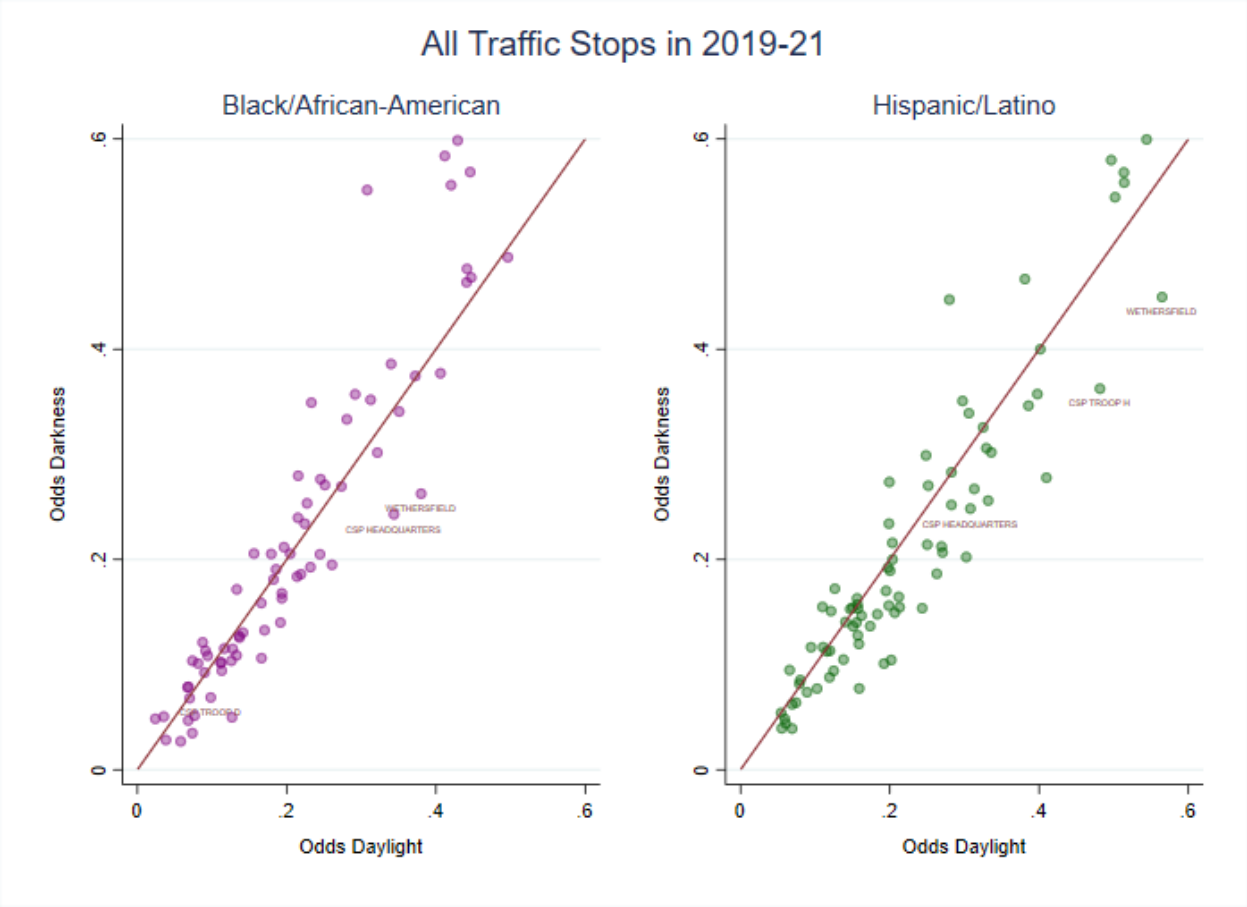
Notes: Coefficient estimates are obtained from Table C.7 of Appendix C, exponentiated and converted into a probability, and then imposed on the likelihood a minority is stopped in darkness for each department. The change in the odds a minority motorist was represented in the traffic stop data is estimated with controls for hour and day of the week. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops within the inter-twilight window as well as in a robustness check focusing on moving violations (Table C.8 of Appendix C). Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

In order to test for disparities in smaller departments where we are unable to precisely estimate the effect of daylight in the annual report due to an insufficiently small sample within the inter-twilight window, we leverage data from 2019-21. As with the previous figure, Figure 3.8 plots the odds a Black (left panel) or Hispanic (right panel) motorist is stopped relative to a non-Hispanic Caucasian motorist in daylight versus darkness by department in the 2019-21 sample. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the odds a stopped motorist is a minority in darkness and the horizontal axis plots the same odds in daylight. For ease of presentation in the figure, we approximate the regression results by imposing the coefficient estimate of daylight from Table C.9 of Appendix C on the unadjusted odds a minority motorist is stopped in darkness during the inter-twilight window.[7] The red 45-degree line represents parity (equal treatment) between daylight and darkness amongst minorities and non-Hispanic

[7] More specifically, the odds of a minority stop in darkness is the uncontrolled raw level rather than the regression adjusted level. We do this for simplicity and ease of exposition.

Caucasians. Thus, only departments falling below this line (bottom right quadrant) are more likely to stop minority motorists during daylight when their race is more easily visible. We annotate only those departments where the difference is statistically significant at or above the 95% confidence level in the overall sample of traffic stops as well as the robustness test using only moving violations. Applying the test to the combined 2019-21 data, we find evidence of a statistically significant disparity in State Police Headquarters (Black & Hispanic), State Police Troop D (Black), State Police Troop H (Hispanic), and Wethersfield (Hispanic & Black). We also note that Clinton (Hispanic) and CSP Troop L (Hispanic) appeared sporadically on some of the specifications and that Farmington, Hartford, Orange, and Waterford appeared but did not survive robustness tests. However, only State Police Headquarters, State Police Troop D, and Wethersfield survived the robustness test where the sample is restricted to moving violations.

Figure 3.8: Veil of Darkness Analysis, All Departments 2019-21



Notes: Coefficient estimates are obtained from Table C.7 of Appendix C, exponentiated and converted into a probability, and then imposed on the likelihood a minority is stopped in darkness for each department. The change in the odds a minority motorist was represented in the traffic stop data is estimated with controls for hour and day of the week. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops within the inter-twilight window as well as in a robustness check focusing on moving violations (Table C.8 of Appendix C). Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

In total, we identify no departments in the 2021 sample and four departments in the 2019-21 sample. For these departments, we conclude that there is strong evidence that a disparity exists in the rate of

minority traffic stops made during daylight conditions. We note that all disparities identified in this section are limited to those occurring within a window of time during the evening commute when the timing of sunset varies throughout the year. Although it is impossible to link these observed disparities to racial profiling as the differences could be driven by policing policy or individual bad actors, these results provide strong evidence police in these areas are treating that minority motorists differently during daylight.

IV: ANALYSIS OF TRAFFIC STOPS, SYNTHETIC CONTROL

Traditional approaches that rely on population-based benchmarks to evaluate policing data must make a variety of very strong assumptions about the underlying risk-set of motorists. These approaches, despite their flaws, are intuitively appealing because they offer tangible easily interpreted measures of potential discrimination. This section presents the results of a synthetic control analysis that has the same intuition as traditional population-based benchmarks or relative rate/disparity indices but remains grounded in rigorous statistical theory. A synthetic control is a unique benchmark constructed for each department using various stop-specific and town-level demographic characteristics as captured through inverse propensity score weighting. The synthetic control is then used to assess the effect of treatment on an outcome variable(s), in this case the probability that a minority motorist is involved in a police traffic stop.[8]

Put simply, departments differ in terms of their enforcement activity (i.e. timing of stops and types of violations, etc.) and the underlying demographics of the population on the roadway. This analysis accounts for these differences by estimating a measure of similarity called a propensity score. Here, a propensity score is a measure of how similar a stop made outside a given department is to a stop made by the department being analyzed. These measures of similarity are used to weight stops when constructing an individual benchmark for each department. For example, if the department being analyzed has a high minority population and makes most of their stops on Friday nights at 7 PM for speeding violations then stops made for speeding by departments with a similar residential population at this time and day will be given more weight when constructing the benchmark. This methodology ensures that there is an apples-to-apples comparison between the number of minorities stopped in a given town relative to their benchmark and allows for the interpretation of any remaining differences to be attributed to possible disparate treatment.

Weighting the observations by the inverse of the propensity score ensures that the distribution of observable characteristics is consistent between the department of interest and the so-called "synthetic control". As long as these observed variables fully capture selection into treatment, inverse propensity score weighting allows for an unbiased estimate of the effect of treatment on the outcome of interest. In the present context, constructing a synthetic control using inverse propensity score weights allow for an assessment of whether specific departments are disproportionately stopping minority motorists. A detailed description of the mechanics underlining this methodology as well as the current application can be found in Appendix A.3. Generally speaking, the synthetic control approach follows a rich and extensive literature spanning the fields of statistics, economics, and public policy. The application of similar methodologies to policing data has recently entered the criminal justice literature through notable applications by McCaffrey et al. (2004), Ridgeway (2006), and Ridgeway and MacDonald (2009).

[8] In the methodological discussion here and in the appendix, the details of the estimation procedure are presented as if a single treatment effect were estimated using a single outcome variable. However, the estimates were constructed for each municipal department using four different outcome variables for the minority groupings used throughout the report

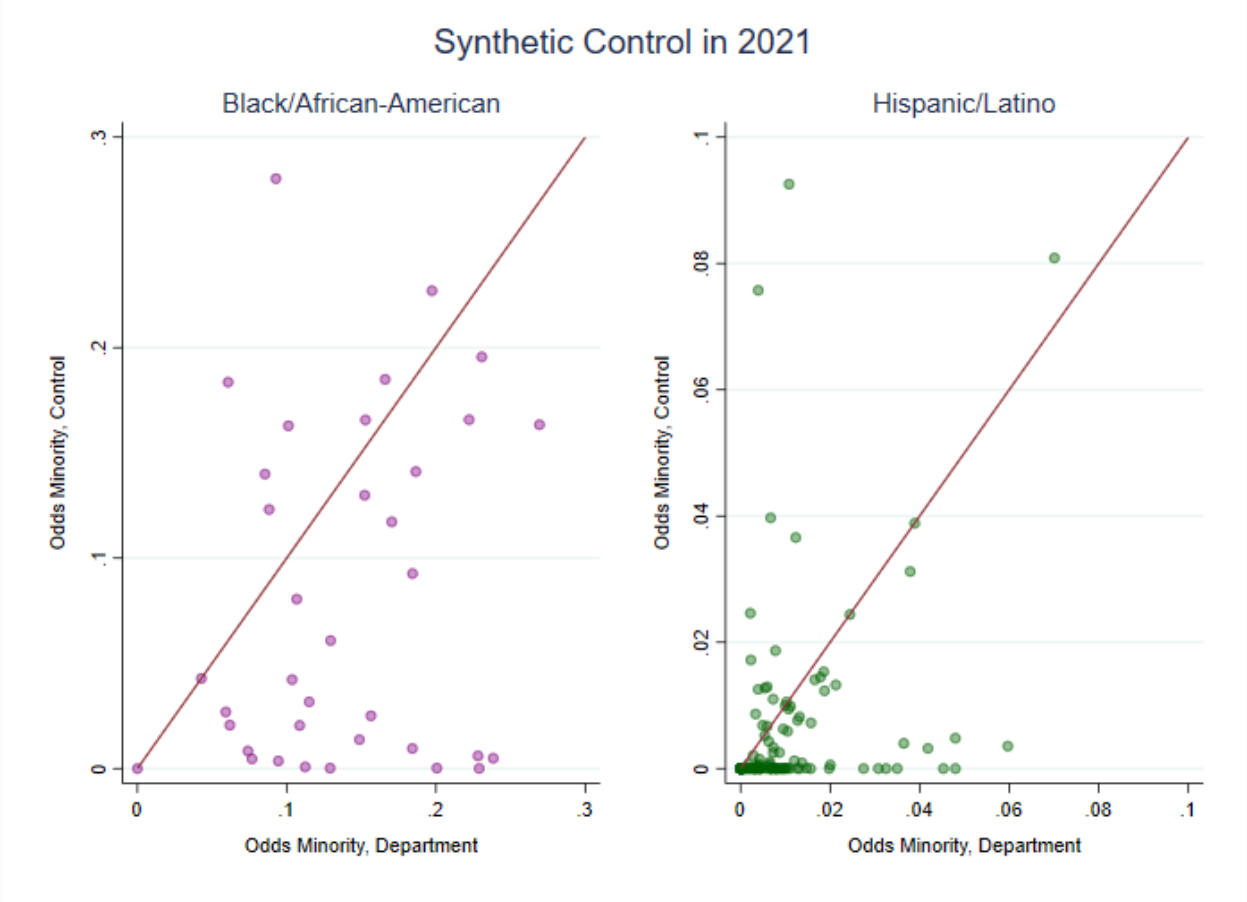
IV.A: AGGREGATE ANALYSIS WITH SYNTHETIC CONTROL, 2021 AND 2019-2021

Each municipal police department was examined independently by weighting observations with inverse propensity scores estimated using Equation 7 of Appendix A.3. The variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Treatment effects were estimated using Equation 8 of Appendix A.3 for individual departments and State Police troops across four demographic subgroups relative to non-Hispanic Caucasians. As before, we identify all departments found to have a disparity that is statistically significant at the 95% level in either the Hispanic or Black alone minority group. In this section, we graphically present the results from the synthetic control analysis and annotate towns with a statistically significant disparity in the rate of Black or Hispanic stops. We first provide results for the 2021 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2019-21 and graphically present estimates for smaller departments which previously had an insufficiently small sample to run the test on an annual basis. In the figures and discussion below, we highlight only the departments found to have a statistically significant disparity in the Black or Hispanic alone categories for either the 2021 or combined 2019-21 samples. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either of the Hispanic or Black alone minority groups. Further, we only highlight departments that withstand more rigorous doubly-robust estimation and that have a false discovery rate below 10% in both specifications. We provide the full set of results in Tables D.1 and D.3 and doubly-robust estimation in D.2 and D.4 of Appendix D.

Figure 4.1 plots the odds a Black (left panel) or Hispanic (right panel) motorist is stopped relative to a non-Hispanic Caucasian motorist in the focal town versus a synthetic control in 2021. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the odds a stopped motorist is a minority in the synthetic control and the horizontal axis plots the same odds for the focal department. For ease of presentation in the figure, we approximate the regression results by imposing the estimated difference from Table D.1 of Appendix D on the unadjusted odds a minority motorist is stopped in focal department such that we obtain an estimate of the odds for the control. The red 45-degree line represents parity (equal treatment) between the focal department and control amongst minorities and non-Hispanic Caucasians. Thus, only departments falling below this line (bottom right quadrant) are more likely to stop minority motorists relative to their synthetic control. We omit annotation of individual departments for the sake of parsimony and instead note those departments in the preceding paragraph where the difference is statistically significant at or above the 95% confidence level in the main specification as well as with doubly-robust estimation.

Applying this test to the 2021 data, we identify the following departments: Avon (Hispanic), Bridgeport (Black), Brookfield (Hispanic), Cheshire (Black), CSP Troop H (Hispanic), CSP Troop K (Black & Hispanic), East Haven (Hispanic), Farmington (Hispanic), Hamden (Hispanic), Meriden (Hispanic), New Canaan (Hispanic), New London (Hispanic), North Haven (Black), Orange (Black & Hispanic), Stratford (Hispanic), Wallingford (Hispanic), Waterford (Black), Watertown (Black), Wethersfield (Hispanic), and Windsor Locks (Black). All of these departments had a disparity in the Black or Hispanic alone category which was significant at a level exceeding 95% confidence, withstood doubly-robust estimation, and had a false discovery rate below 10%. For the full results, see Table D.2 for the baseline specification and Table D.1 of Appendix D for the double-robust estimates.

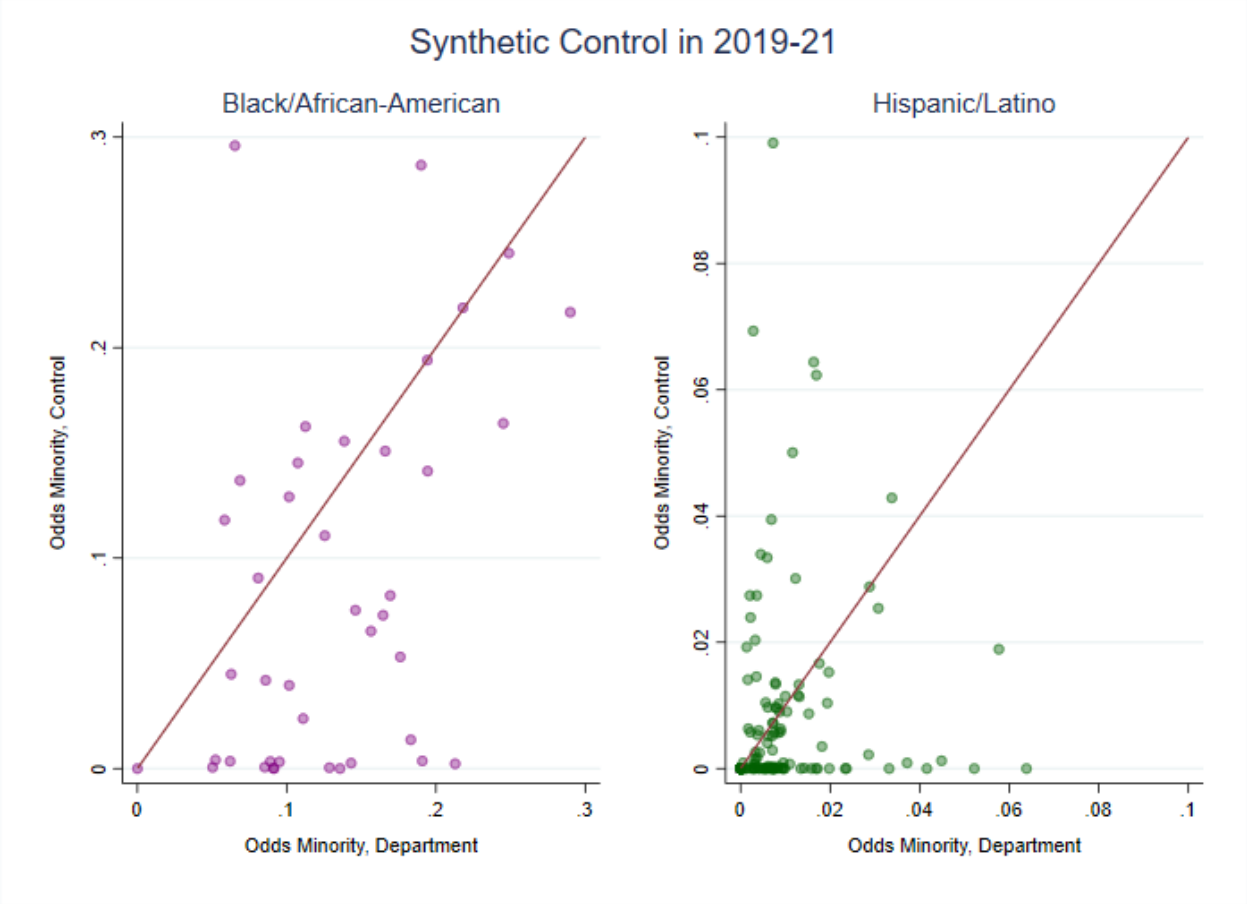
Figure 4.1: Synthetic Control Analysis, All Departments 2021



Notes: Coefficient estimates are obtained from Table D.1 of Appendix D and imposed on the raw odds that a minority is stopped in the focal department. The change in the odds a minority motorist was represented in the traffic stop data in the focal town is estimated using Equation 7 of Appendix A.3 where the variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops as well as in a robustness check with doubly-robust estimation (Table D.2 of Appendix D). Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

Figure 4.2 contains estimates for the aggregate 2019-21 and follows the same format discussed above in reference to Figure 4.1. Applying this test to the 2019-21 data where we gain precision by utilizing a larger sample of traffic stops, we identify the departments of: Brookfield (Hispanic), CSP Troop H (Hispanic), CSP Troop I (Black & Hispanic), Derby (Hispanic), East Haven (Hispanic), Farmington (Black), Granby (Black), Meriden (Hispanic), Monroe (Black), New Haven (Black), New London (Black), Newington (Hispanic), North Haven (Black), Orange (Black & Hispanic), Plainville (Hispanic), Plymouth (Hispanic), Stonington (Black), Wallingford (Black & Hispanic), Waterford (Hispanic), Watertown (Hispanic), Wethersfield (Black & Hispanic), Wilton (Black), and Wolcott (Black & Hispanic). For the full results, see Table D.4 for the baseline specification and Table D.3 of Appendix D for the double-robust estimates.

Figure 4.2: Synthetic Control Analysis, All Departments 2019-21



Notes: Coefficient estimates are obtained from Table D.3 of Appendix D and imposed on the raw odds that a minority is stopped in the focal department. The change in the odds a minority motorist was represented in the traffic stop data in the focal town is estimated using Equation 7 of Appendix A.3 where the variables used to estimate the propensity scores are detailed in Table A.2 (1) of Appendix A.3. Annotated departments include only those with a statistically significant disparity estimated with a confidence level at or exceeding the 95% in the combined sample of all traffic stops as well as in a robustness check with doubly-robust estimation (Table D.4 of Appendix D). Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

V: ANALYSIS OF TRAFFIC STOPS, DESCRIPTIVE STATISTICS AND INTUITIVE MEASURES

The descriptive statistics and benchmarks presented in this section help to understand patterns in Connecticut policing data. Although these simple statistics present an intriguing story, conclusions should not be drawn from any one measure alone. The two previously applied statistical tests of racial and ethnic disparities in the policing data are based solely on the policing data itself and rely on the construction of a theoretically derived identification strategy and a natural experiment. These results have been applied by academic and police researchers in numerous areas across the country and are generally considered to be the most current and relevant approaches to assessing policing data.

In all the benchmark analysis, the demography of motorists was grouped into three overlapping categories to ensure a large enough sample size for the analysis. Much of the analysis focuses on stops made of black (Hispanic or non-Hispanic) and Hispanic motorists (any race), the analysis also was conducted for aggregated groupings of all non-white motorists (Hispanic or non-Hispanic).

V.A: STATEWIDE AVERAGE COMPARISON

Comparing town data to statewide average data is frequently the first thing the public does when trying to understand and assess how a police department may be conducting traffic stops. In this section, a comparison to the statewide average is presented alongside the context necessary to understand the information. This benchmark does provide a simple and effective way to establish a baseline for all towns from which the relative differences between town stop numbers become more apparent. A detailed explanation of the methodology can be found in Appendix A.4. The analysis presented in this report only identified the departments for which the statewide average comparison indicated the largest distances between the net stop percentage and net resident population using 10 or more points as a threshold. Tables showing the calculations for all departments, rather than just those showing distance measures of more than 10 points, can be found in Appendix E of this report. Readers should note that this section focuses entirely on departments that exceeded the statewide average for stops in these racial groups.

Comparison of Racial/Ethnic Minority Drivers to the State Average

The racial/ethnic minority category includes all racial classifications except for white drivers. Specifically, it covers Blacks, Hispanics, Asian/Pacific Islander, American Indian/Alaskan Native, and Other Race classifications included in the census data.

For the study period from January 1, 2021 through December 31, 2021, the statewide percentage of drivers stopped by police who were identified as Minority was 39.3%. A total of 29 departments stopped a higher percentage of Minority drivers than the state average, 15 of which exceeded the statewide average by more than 10 percentage points. The statewide average for Minority residents (16+) is 25.2%. Of the 29 towns that exceeded the statewide average for Minority drivers stopped, 20 also have Minority resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), a total of 17 departments were found to have a relative distance between their net Minority driver stop percentage and net Minority driving age population percentage of more than 10 points. Table 5.1 shows the data for these 17 departments. All department results are contained in the Table E.1 of Appendix E.

Table 5. 1: Statewide Average Comparisons for Minority Drivers for Selected Towns

Municipal Department	Minority Stops	Difference Between Town and State Average	Minority Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Newington	55.5%	16.2%	14.5%	-10.7%	26.9%
Orange	51.1%	11.8%	10.7%	-14.5%	26.2%
Wethersfield	44.4%	5.1%	12.5%	-12.8%	17.8%
Naugatuck	46.6%	7.3%	15.2%	-10.1%	17.4%
Stratford	57.7%	18.4%	27.2%	2.0%	16.4%
South Windsor	44.1%	4.8%	14.6%	-10.6%	15.4%
Darien	36.4%	-2.9%	7.2%	-18.1%	15.1%
Wilton	36.4%	-2.9%	8.1%	-17.1%	14.2%
Vernon	41.0%	1.7%	14.1%	-11.2%	12.9%
Woodbridge	39.8%	0.5%	12.8%	-12.4%	12.9%
New Britain	71.8%	32.5%	45.0%	19.8%	12.7%
Wallingford	37.1%	-2.2%	11.1%	-14.1%	11.9%
Berlin	31.1%	-8.2%	5.8%	-19.5%	11.3%
East Haven	39.3%	0.0%	14.0%	-11.3%	11.2%
Enfield	33.9%	-5.4%	8.7%	-16.6%	11.2%
Derby	45.2%	5.9%	20.6%	-4.7%	10.6%
West Hartford	46.4%	7.1%	21.8%	-3.4%	10.5%
Connecticut	39.3%	0.0%	25.2%	0.0%	NA

Comparison of Black Drivers to the State Average

For the study period, the statewide percentage of motorists stopped by police who were identified as Black was 18.7%. A total of 27 departments stopped a higher percentage of Black motorists than the state average, 8 of which exceeded the statewide average by more than 10 percentage points. The statewide average for Black residents (16+) is 9.1%. Of the 27 towns that exceeded the statewide average for Black drivers stopped, 15 also have Black resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), a total of 4 departments[9] were found to have a relative distance between their net Black driver stop percentage and net Black driving age population percentage of more than 10 points. Table 5.2 shows the data for these 4 towns. All department results are contained in the Table E.2 of Appendix E.

[9] The Groton Long Point police department exceeded the disparity threshold by more than 10 percent, but only reported six traffic stops in 2021. They were excluded from this summary.

Table 5. 2: Statewide Average Comparisons for Black Drivers for Selected Towns

Municipal Department	Black Stops	Difference Between Town and State Average	Black Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Orange	28.5%	9.8%	1.3%	-7.8%	17.6%
Woodbridge	24.6%	5.9%	1.9%	-7.2%	13.1%
Derby	28.0%	9.3%	6.0%	-3.1%	12.4%
Stratford	32.4%	13.7%	12.8%	3.6%	10.0%
Connecticut	18.7%	0.0%	9.1%	0.0%	NA

Comparison of Hispanic Drivers to the Statewide Average

For the study period, the statewide percentage of drivers stopped by police who were identified as Hispanic was 17.6%. A total of 28 towns stopped a higher percentage of Hispanic drivers than the state average, 10 of which exceeded the statewide average by more than 10 percentage points. The statewide Hispanic resident population (16+) is 11.9%. Of the 28 towns that exceeded the statewide average for Hispanic drivers stopped, 13 also have Hispanic resident populations (16+) that exceeded the statewide average.

After the stop and resident population percentages were adjusted using the method described in Appendix A.3 (2), a total of 7 towns were found to have a relative distance between their net Hispanic driver stop percentage and net Hispanic population percentage of more than 10 points. Table 5.3 shows the data for the towns named above. All department results are contained in the Table E.3 of Appendix E.

Table 5. 3: Statewide Average Comparisons for Hispanic Drivers for Selected Towns

Municipal Department	Hispanic Stops	Difference Between Town and State Average	Hispanic Residents Age 16+	Difference Between Town and State Average	Distance Between Net Differences
Newington	30.1%	12.5%	6.4%	-5.5%	18.0%
Wethersfield	25.7%	8.1%	7.1%	-4.8%	12.9%
New Britain	49.2%	31.6%	31.8%	19.8%	11.8%
Naugatuck	25.0%	7.4%	7.8%	-4.1%	11.5%
Orange	19.8%	2.2%	2.5%	-9.4%	11.5%
Darien	20.5%	2.9%	3.5%	-8.4%	11.3%
Wilton	19.4%	1.8%	2.7%	-9.2%	11.0%
Connecticut	17.6%	0.0%	11.9%	0.0%	NA

V.B: ESTIMATED DRIVING POPULATION COMPARISON

In the previous reports, researchers conducted an analysis using an estimated driving population comparison. The EDP analysis was confined to the 94 municipal police departments in Connecticut. This methodology was designed to better understand how employment commutation can impact a community's driving population during peak commuting hours. The Covid-19 pandemic dramatically altered how and where people work. Researchers are working to determine the impact that the

Covid-19 pandemic has had on commutation patterns. Therefore, the EDP methodology is not utilized in this report.

V.C: RESIDENT ONLY STOP COMPARISON

Overall, when compared to the census, 85 departments stopped more non-white resident drivers than their non-white resident population. Again, the disparity for many of these departments was very small. In 8 communities, the disparity was negative, meaning that fewer non-white drivers were stopped than expected based on the population numbers. However, the negative disparities were also very small in most communities. Almost all departments (88 of 94) had a disparity for Black drivers stopped and 69 departments had a disparity for Hispanic drivers stopped when compared to the resident driving age population.

Departments with a difference of 10 percentage points or more between the resident stops and the 16+ resident population in any of the three categories: (1) Minority (all race/ethnicity), (2) Black non-Hispanic, and (3) Hispanic, were identified in our tier one group. Table 5.4 shows the data for the departments meeting the tier one criteria. In addition, departments that exceeded their resident population percentage by more than five but less than 10 percentage points were identified in our tier two group for this benchmark if the ratio of the percentage of resident stops for the target group compared to the baseline measure for that group also was 1.75 or above (percentage of stopped residents divided by resident benchmark percentage equals 1.75 or more) in any of three categories: (1) Minority (all race/ethnicity), (2) Black non-Hispanic, and (3) Hispanic. Table 5.5 shows the data for the departments meeting the tier two criteria. Results for all departments are available in Tables E.4, E.5, and E.6 of Appendix E.

Table 5. 4: Highest Ratio of Resident Population to Resident Stops (Tier I)

Department Name	Number of Residents	Residents	Resident Stops	Minority Resident Stops	Difference	Ratio
Minority (All Non-White)						
New Britain	57,164	45.0%	2,322	78.4%	33.4%	1.74
Waterbury	83,964	48.1%	1,280	81.5%	33.4%	1.69
Willimantic	20,176	34.6%	387	63.3%	28.8%	1.83
Derby	10,391	20.6%	71	46.5%	25.9%	2.26
Groton City	7,960	26.9%	423	52.7%	25.8%	1.96
Vernon	23,800	14.1%	383	39.7%	25.6%	2.82
New London	21,835	43.6%	677	68.4%	24.8%	1.57
Manchester	46,667	27.9%	1,333	52.4%	24.4%	1.87
Naugatuck	25,099	15.2%	1,074	39.5%	24.3%	2.60
Norwich	31,638	29.1%	1,395	52.9%	23.8%	1.82
Danbury	64,361	38.6%	763	61.6%	23.0%	1.59
Meriden	47,445	34.9%	1,986	57.6%	22.7%	1.65
Windsor	23,222	43.9%	3,519	65.6%	21.6%	1.49
East Hartford	40,229	51.6%	1,596	72.6%	20.9%	1.41
Enfield	33,218	8.7%	1,279	29.4%	20.7%	3.40
Hamden	50,012	30.9%	308	51.6%	20.7%	1.67
Bristol	48,439	12.7%	741	33.3%	20.6%	2.62
Stratford	40,980	27.2%	275	47.3%	20.1%	1.74
New Haven	100,702	62.8%	3,952	81.3%	18.4%	1.29

Department Name	Number of Residents	Residents	Resident Stops	Minority Resident Stops	Difference	Ratio
South Windsor	20,162	14.6%	598	32.9%	18.3%	2.26
West Haven	44,518	37.6%	1,054	55.5%	17.9%	1.48
Newington	24,978	14.5%	282	31.2%	16.7%	2.15
Middletown	38,747	23.5%	629	40.1%	16.6%	1.71
Bloomfield	16,982	61.5%	753	76.9%	15.4%	1.25
Torrington	29,251	11.0%	3,335	26.1%	15.0%	2.36
Clinton	10,540	6.1%	361	19.1%	13.0%	3.12
Ansonia	14,979	25.6%	812	38.3%	12.7%	1.49
New Milford	21,891	9.7%	778	22.1%	12.4%	2.28
Groton Town	31,520	20.4%	829	32.7%	12.3%	1.60
West Hartford	49,650	21.8%	405	33.8%	12.0%	1.55
Woodbridge	7,119	12.8%	129	24.8%	12.0%	1.93
Plymouth	9,660	2.5%	464	14.4%	12.0%	5.84
Seymour	13,260	9.8%	593	20.7%	11.0%	2.12
Shelton	32,010	10.8%	23	21.7%	10.9%	2.01
Farmington	20,318	12.6%	627	23.1%	10.5%	1.84
East Windsor	9,164	14.6%	352	25.0%	10.4%	1.71
East Haven	24,114	14.0%	782	24.0%	10.1%	1.72
Black						
Groton City*	7,960	7.70%	423	30.5%	22.8%	3.96
New Haven	100,702	32.16%	3,952	53.5%	21.3%	1.66
Windsor	23,222	32.20%	3,519	53.1%	20.9%	1.65
Manchester	46,667	10.15%	1,333	30.9%	20.8%	3.04
Bridgeport	109,401	31.82%	1,049	52.3%	20.5%	1.64
Derby	10,391	6.03%	71	25.4%	19.3%	4.20
Hamden	50,012	18.28%	308	37.3%	19.1%	2.04
Norwich	31,638	8.96%	1,395	27.5%	18.5%	3.06
East Hartford	40,229	22.52%	1,596	40.2%	17.7%	1.79
Vernon	23,800	4.70%	383	21.9%	17.2%	4.67
Middletown	38,747	11.68%	629	28.5%	16.8%	2.44
New London	21,835	15.18%	677	31.9%	16.7%	2.10
Bloomfield	16,982	54.76%	753	70.7%	15.9%	1.29
Waterbury	83,964	17.37%	1,280	33.0%	15.7%	1.90
Stratford	40,980	12.76%	275	28.0%	15.2%	2.20
West Haven	44,518	17.70%	1,054	31.8%	14.1%	1.80
Naugatuck	25,099	4.11%	1,074	17.3%	13.2%	4.21
Enfield	33,218	2.63%	1,279	14.6%	12.0%	5.56
Meriden	47,445	7.80%	1,986	18.4%	10.6%	2.36
Groton Town	31,520	6.07%	829	16.5%	10.5%	2.72
Hispanic						
Danbury	64,361	23.25%	763	50.9%	27.6%	2.19
New Britain	57,164	31.75%	2,322	58.0%	26.3%	1.83
Willimantic	20,176	28.88%	387	51.7%	22.8%	1.79
Waterbury	83,964	27.54%	1,280	47.7%	20.1%	1.73
Bristol	48,439	7.65%	741	21.1%	13.4%	2.75
Meriden	47,445	24.86%	1,986	38.2%	13.3%	1.54
Naugatuck	25,099	7.77%	1,074	20.9%	13.2%	2.70
Norwich	31,638	10.59%	1,395	22.5%	11.9%	2.13
New London	21,835	25.08%	677	35.5%	10.4%	1.41

Department Name	Number of Residents	Residents	Resident Stops	Minority Resident Stops	Difference	Ratio
Clinton	10,540	4.41%	361	14.7%	10.3%	3.33
Torrington	29,251	6.92%	3,335	16.9%	10.0%	2.45

Table 5. 5: High Ratio of Resident Population to Resident Stops (Tier II)

Department Name	Number of Residents	Residents	Resident Stops	Minority Resident Stops	Difference	Ratio
Minority (All Non-White)						
Wethersfield	21,607	12.5%	351	22.2%	9.8%	1.78
Wallingford	36,530	11.1%	612	19.8%	8.6%	1.77
Plainville	14,605	10.0%	413	17.7%	7.7%	1.77
Redding	6,955	4.4%	133	11.3%	6.9%	2.58
Wilton	12,973	8.1%	730	14.4%	6.3%	1.78
Brookfield	12,847	8.1%	125	14.4%	6.3%	1.78
Coventry	9,779	3.8%	291	10.0%	6.2%	2.63
Putnam	7,507	3.4%	433	9.5%	6.1%	2.81
Old Saybrook	8,330	5.2%	356	11.2%	6.1%	2.18
Black						
Newington	24,978	2.99%	282	12.8%	9.8%	4.26
New Britain	57,164	10.67%	2,322	19.2%	8.5%	1.80
Ledyard	11,527	3.10%	716	10.9%	7.8%	3.51
Ansonia	14,979	9.74%	812	17.4%	7.6%	1.78
Bristol	48,439	3.24%	741	10.8%	7.6%	3.34
South Windsor	20,162	3.68%	598	10.9%	7.2%	2.96
Shelton	32,010	2.07%	23	8.7%	6.6%	4.20
Seymour	13,260	2.25%	593	8.8%	6.5%	3.90
Cheshire	21,049	1.27%	238	7.6%	6.3%	5.94
West Hartford	49,650	5.65%	405	11.6%	6.0%	2.05
Willimantic	20,176	4.08%	387	9.6%	5.5%	2.34
Windsor Locks	10,117	4.27%	167	9.6%	5.3%	2.24
Torrington	29,251	2.12%	3,335	7.1%	5.0%	3.36
Hispanic						
New Milford	21,891	5.46%	778	15.2%	9.7%	2.78
Groton City*	7,960	11.80%	423	21.0%	9.2%	1.78
East Haven	24,114	8.43%	782	17.6%	9.2%	2.09
Enfield	33,218	4.00%	1,279	13.0%	9.0%	3.25
Greenwich	46,370	9.15%	647	17.2%	8.0%	1.87
Wethersfield	21,607	7.10%	351	14.8%	7.7%	2.09
Vernon	23,800	5.21%	383	12.8%	7.6%	2.45
Bethel	14,675	6.65%	884	14.1%	7.5%	2.13
Wallingford	36,530	6.71%	612	13.2%	6.5%	1.97
Old Saybrook	8,330	2.93%	356	8.7%	5.8%	2.97
East Windsor	9,164	4.34%	352	9.9%	5.6%	2.29
Plainville	14,605	5.18%	413	10.2%	5.0%	1.96

V.D: CONCLUSIONS FROM THE DESCRIPTIVE COMPARISONS

The descriptive tests outlined in the above sections are designed to be used as a screening tool to identify those jurisdictions with consistent data disparities that exceed certain thresholds. The tests compare stop data to two descriptive benchmarks: (1) statewide average and (2) resident-only stops that each cover three driver categories: Black, Hispanic, and Minority. Department data is then measured against the resulting total of nine descriptive measures for evaluation purposes.

In order to classify the disparities within the descriptive benchmarks, any disparity greater than 10 percentage points for a measure was given a weight of one (1) point. Any disparity of more than five, but less than 10 percentage points accompanied by a disparity ratio of 1.75 or above was given a weight of 0.5 points. Therefore, a department could score no more than nine (6) total points.

Table 5.6 identifies the 7 departments with significant disparities. A department was identified if the stop data was found to exceed the disparity threshold level in both of the benchmarks and a weighted total score of 3.5 or more. All department results are contained in Table E.7 of Appendix E.

Table 5.6: Departments with the Greatest Number of Disparities Relative to Descriptive Benchmarks

Department Name	Statewide Average			Resident Population			Point Total
	M	B	H	M	B	H	
Naugatuck	17.4%		11.5%	24.3%	13.2%	13.2%	5.0
New Britain	12.7%		11.8%	33.4%	8.5%	26.3%	4.5
Derby	10.6%	12.4%		25.9%	19.3%		4.0
Stratford	16.4%	10.0%		20.1%	15.2%		4.0
Enfield	11.2%			20.7%	12.0%	9.0%	3.5
Newington	26.9%		18.0%	16.7%	9.8%		3.5
Vernon	12.9%			25.6%	17.2%	7.6%	3.5

VI. ANALYSIS OF STOP DISPOSITIONS

In this section, we test for disparities in the outcomes of traffic stops using a model that examines the distribution of dispositions conditional on race and the reason for the stop. Specifically, we test whether traffic stops made of minority motorists result in different outcomes relative to their non-Hispanic Caucasians peers following the model outlined in Equation 10 of Appendix A.6. Since ex-ante it is unclear whether discrimination would create more or less severe traffic stop outcomes in the data, we simply test for equality in the distribution of outcomes across demography conditional on the motivating reason for the stop. Rather than making unreasonable assumptions about how discrimination should affect outcomes, we simply assume that the overall distribution will not be equal across race. The intuition is similar to hit-rate style tests but where we are unable to ex-ante sign the direction that we expect the bias to take. We implement the test by applying a multinomial logistic regression on the four possible stop outcomes and conditions on race and the reason for the stop. We then conduct a joint hypothesis test on the interaction between an indicator of race and the reason for the stop.

We account for differences in outcomes not related to this interaction term by including additional controls for age, gender, hour, day of the week, week of year, and officer fixed effects. In terms of possible outcomes, we regress indicators for warning (no search), arrest (no search), ticket/misdemeanor (search), warning (search), arrest (search), and where ticket/misdemeanor (no search) is the omitted category. We condition on the basis of the stop using five indicators for stops made on the basis of equipment violation, seatbelt/cellphone, registration/license, all other violations, and where speeding violations are the omitted category. We provide one important cautionary note about interpreting our test as causal evidence of discrimination. Ideally, this test would be performed on data containing *all* violations observed by the police officer prior to making a traffic stop and where we would include a control for the number of total violations. In practice, data on traffic stops typically only contain the most severe reason that motivated the stop. In the absence of data on the full set of violations observed by police officers, we suggest that the reader interpret results from this test as providing descriptive evidence to be viewed in concert with other such empirical measures.

VI.A: AGGREGATE ANALYSIS OF STOP DISPOSITION, 2021

Table 6.1 presents the results of applying a multinomial logit to a sample of all traffic stops with six distinct stop outcomes regressed on race, stop basis, and their interaction. Unlike prior sections where we utilized the historical timeseries data in the aggregate analysis and a three-year combined sample for the department analysis, we focus on only the 2021 data in this section. Our focus on the 2021 data is due to the fact that this test relies on the full sample of traffic stops, rather than a smaller and more restrictive subsample. Below, we present the coefficient estimates on the interaction between race and the stop basis for each outcome relative to the omitted category, i.e. no search-ticket/misdemeanor issued. In contrast to prior years, we find no discernible pattern that minority motorists are treated differently in any uniform way relative to their non-Hispanic Caucasians counterparts. However, a hypothesis test across all the interaction terms and all outcomes indicate

that the difference in outcomes are still jointly statistically significant at the 99% level for each demographic group relative to non-Hispanic Caucasians motorists.

Table 6.1: Multinomial Logistic Regression of Outcome on Race/Ethnicity and Reason for Stop, All Traffic Stops 2021

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.227	(0.149)	0.147	(0.16)	0.081	(0.102)	0.1	(0.117)
Equip.	-0.126	(0.195)	-0.187	(0.207)	-0.226*	(0.136)	-0.238	(0.149)
Reg. or Lic.	0.394*	(0.13)	0.358*	(0.146)	0.167*	(0.101)	0.236*	(0.111)
Signal or Stop	0.015	(0.079)	-0.004	(0.085)	-0.039	(0.077)	-0.071	(0.069)
Moving	0.353*	(0.112)	0.348*	(0.119)	0.252*	(0.091)	0.293*	(0.093)
No Search, Arrest								
All Other	-0.435*	(0.187)	-0.527*	(0.195)	-0.439*	(0.199)	-0.515*	(0.178)
Equip.	0.216	(0.237)	0.191	(0.244)	-0.16	(0.198)	-0.006	(0.19)
Reg. or Lic.	0.106	(0.224)	0.061	(0.246)	0.005	(0.216)	-0.002	(0.2)
Signal or Stop	0.02	(0.171)	0.012	(0.185)	-0.009	(0.171)	-0.027	(0.142)
Moving	-0.494*	(0.16)	-0.523*	(0.165)	-0.08	(0.137)	-0.3*	(0.113)
Search, Ticket or Misdemeanor								
All Other	-0.324	(0.197)	-0.446*	(0.202)	-0.466*	(0.187)	-0.485*	(0.168)
Equip.	-0.219	(0.241)	-0.307	(0.248)	-0.511*	(0.234)	-0.437*	(0.209)
Reg. or Lic.	0.228	(0.263)	0.172	(0.272)	0.303	(0.299)	0.196	(0.26)
Signal or Stop	0.124	(0.218)	0.117	(0.227)	-0.072	(0.225)	-0.003	(0.204)
Moving	-0.198	(0.224)	-0.219	(0.231)	-0.412*	(0.233)	-0.333*	(0.201)
Search, Warning								
All Other	-0.207	(0.29)	-0.328	(0.283)	-0.156	(0.322)	-0.273	(0.248)
Equip.	-0.222	(0.237)	-0.311	(0.245)	-0.192	(0.231)	-0.313*	(0.184)
Reg. or Lic.	0.299	(0.38)	0.278	(0.398)	0.958*	(0.342)	0.517	(0.321)
Signal or Stop	-0.39	(0.242)	-0.4	(0.246)	-0.503*	(0.267)	-0.488*	(0.215)
Moving	0.007	(0.314)	0.017	(0.335)	-0.152	(0.285)	-0.074	(0.287)
Search, Arrest								
All Other	-0.562*	(0.194)	-0.685*	(0.194)	-0.247	(0.222)	-0.472*	(0.157)
Equip.	0.029	(0.286)	-0.051	(0.291)	-0.169	(0.257)	-0.138	(0.232)
Reg. or Lic.	0.236	(0.271)	0.233	(0.264)	0.417	(0.361)	0.288	(0.255)
Signal or Stop	-0.01	(0.246)	-0.032	(0.258)	-0.338	(0.245)	-0.211	(0.203)
Moving	-0.668*	(0.214)	-0.644*	(0.197)	-0.143	(0.22)	-0.38*	(0.152)
Chi^2	3.60E+08		2.92E+02		138.8		2.27E+02	
P-Value	0		0		0		0	
Sample Size	237,110		227,857		220,970		274,221	

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.

Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.

Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

Table 6.2 presents the results of applying a multinomial logit to a subset of traffic stops made by municipal police departments. As before, we test for differences across six distinct stop outcomes for motorists of different races but who were stopped for the same reason. Across all specifications, we do not observe any discernible pattern suggesting minority motorists are treated differently in any

uniform way. However, a joint hypothesis test across all the interaction terms and all outcomes indicate that the difference in outcomes is statistically significant at the 99% level for each demographic group relative to non-Hispanic Caucasians motorists.

Table 6.2: Multinomial Logistic Regression of Outcome on Race/Ethnicity and Reason for Stop, Municipal Traffic Stops 2021

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.288	(0.222)	0.256	(0.236)	0.254*	(0.111)	0.24	(0.157)
Equip.	0.035	(0.228)	-0.004	(0.239)	-0.063	(0.128)	-0.059	(0.154)
Reg. or Lic.	0.697*	(0.199)	0.721*	(0.225)	0.473*	(0.143)	0.584*	(0.162)
Signal or Stop	0.081	(0.108)	0.084	(0.117)	0.005	(0.086)	0.005	(0.091)
Moving	0.537*	(0.14)	0.58*	(0.165)	0.416*	(0.121)	0.46*	(0.124)
No Search, Arrest								
All Other	-0.146	(0.238)	-0.143	(0.249)	-0.166	(0.2)	-0.199	(0.195)
Equip.	0.136	(0.255)	0.141	(0.265)	-0.198	(0.234)	-0.055	(0.208)
Reg. or Lic.	-0.127	(0.261)	-0.116	(0.298)	0.081	(0.269)	-0.064	(0.231)
Signal or Stop	-0.131	(0.19)	-0.069	(0.196)	-0.069	(0.206)	-0.094	(0.164)
Moving	-0.436*	(0.197)	-0.418*	(0.21)	-0.163	(0.201)	-0.316*	(0.175)
Search, Ticket or Misdemeanor								
All Other	-0.128	(0.22)	-0.248	(0.233)	-0.305	(0.212)	-0.3	(0.195)
Equip.	-0.14	(0.265)	-0.241	(0.276)	-0.43*	(0.237)	-0.357	(0.218)
Reg. or Lic.	0.401	(0.296)	0.346	(0.311)	0.402	(0.378)	0.355	(0.322)
Signal or Stop	0.214	(0.206)	0.218	(0.21)	-0.078	(0.231)	0.056	(0.196)
Moving	-0.002	(0.279)	-0.031	(0.285)	-0.268	(0.289)	-0.182	(0.241)
Search, Warning								
All Other	-0.183	(0.346)	-0.203	(0.358)	-0.103	(0.38)	-0.174	(0.305)
Equip.	0.01	(0.274)	-0.018	(0.288)	0.008	(0.25)	-0.047	(0.189)
Reg. or Lic.	0.466	(0.43)	0.517	(0.442)	1.241*	(0.373)	0.797*	(0.344)
Signal or Stop	-0.241	(0.285)	-0.197	(0.287)	-0.397	(0.302)	-0.312	(0.242)
Moving	0.443	(0.304)	0.509	(0.31)	0.271	(0.313)	0.38	(0.258)
Search, Arrest								
All Other	-0.351	(0.249)	-0.454*	(0.252)	0.331	(0.254)	-0.141	(0.2)
Equip.	-0.07	(0.308)	-0.157	(0.317)	0.068	(0.304)	-0.128	(0.268)
Reg. or Lic.	0.439*	(0.265)	0.441	(0.272)	0.915*	(0.386)	0.571*	(0.246)
Signal or Stop	-0.072	(0.234)	-0.113	(0.245)	-0.125	(0.331)	-0.15	(0.231)
Moving	-0.773*	(0.257)	-0.746*	(0.257)	0.186	(0.325)	-0.352	(0.232)
Chi^2	1.75E+02		1.67E+02		148.01		1.76E+02	
P-Value	0		0		0		0	
Sample Size	151,518		146,367		141,347		177,965	

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.

Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.

Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

Table 6.3 presents the results of applying a multinomial logit to a subset of traffic stops made by Connecticut State Police. As before, we test for differences across six distinct stop outcomes for motorists of different races but who were stopped for the same reason. Across all specifications, we

do not observe any discernible pattern suggesting minority motorists are treated differently in any uniform way. However, a joint hypothesis test across all the interaction terms and all outcomes indicate that the difference in outcomes is statistically significant at the 99% level for each demographic group relative to non-Hispanic Caucasians motorists. Note that we are unable to obtain estimates for Hispanic motorists as the baseline category is seemingly nonexistent for Hispanic motorists stopped by State Police in 2021.

Table 6.3: Multinomial Logistic Regression of Outcome on Race/Ethnicity and Reason for Stop, State Police Traffic Stops 2021

	Non-White		Black		Hispanic		Black or Hispanic	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
No Search, Warning or No Action								
All Other	0.355	(0.244)	0.24	(0.234)	N/A	N/A	0.108	(0.193)
Equip.	-0.131	(0.253)	-0.175	(0.259)	N/A	N/A	-0.236	(0.238)
Reg. or Lic.	0.134	(0.142)	0.034	(0.13)	N/A	N/A	-0.081	(0.103)
Signal or Stop	-0.191*	(0.11)	-0.192	(0.129)	N/A	N/A	-0.087	(0.14)
Moving	0.212	(0.156)	0.167	(0.146)	N/A	N/A	0.149	(0.127)
No Search, Arrest								
All Other	-0.474*	(0.217)	-0.637*	(0.222)	N/A	N/A	-0.555*	(0.176)
Equip.	0.103	(0.701)	0.142	(0.693)	N/A	N/A	-0.044	(0.598)
Reg. or Lic.	0.474	(0.389)	0.4	(0.385)	N/A	N/A	0.115	(0.38)
Signal or Stop	0.404	(0.384)	0.256	(0.533)	N/A	N/A	0.063	(0.458)
Moving	-0.497*	(0.246)	-0.55*	(0.254)	N/A	N/A	-0.251	(0.153)
Search, Ticket or Misdemeanor								
All Other	-0.829*	(0.481)	-0.916*	(0.504)	N/A	N/A	-0.951*	(0.359)
Equip.	0.7	(0.611)	0.74	(0.592)	N/A	N/A	0.129	(0.598)
Reg. or Lic.	0.148	(0.809)	0.137	(0.813)	N/A	N/A	0.201	(0.539)
Signal or Stop	0.302	(0.391)	-0.109	(0.817)	N/A	N/A	0.295	(0.68)
Moving	-0.306	(0.363)	-0.259	(0.37)	N/A	N/A	-0.587*	(0.349)
Search, Warning								
All Other	0.381	(1.131)	-0.028	(1.041)	N/A	N/A	0.198	(0.659)
Equip.	-0.368	(0.58)	-0.494	(0.536)	N/A	N/A	-0.311	(0.535)
Reg. or Lic.	-0.097	(1.014)	-0.227	(1.049)	N/A	N/A	-0.25	(0.762)
Signal or Stop	-0.79	(1.301)	-0.386	(1.213)	N/A	N/A	-0.78	(1.316)
Moving	-0.806	(0.585)	-0.864	(0.63)	N/A	N/A	-0.918*	(0.509)
Search, Arrest								
All Other	-0.652*	(0.264)	-0.729*	(0.265)	N/A	N/A	-0.67*	(0.202)
Equip.	0.7	(0.669)	0.78	(0.715)	N/A	N/A	0.718	(0.617)
Reg. or Lic.	-1.018	(0.721)	-0.948	(0.74)	N/A	N/A	-0.557	(0.674)
Signal or Stop	-0.042	(0.848)	0.249	(0.862)	N/A	N/A	0.093	(0.795)
Moving	-0.407	(0.311)	-0.31	(0.244)	N/A	N/A	-0.327*	(0.149)
Chi^2	3.60E+08		3.26E+01		N/A		6.40E+08	
P-Value	0		0.0003		N/A		0	
Sample Size	84,023		80,010		78,195		94,366	

Note 1: The coefficients are presented as log odds-ratios along with standard errors clustered at the department level. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance.

Note 2: All specifications include controls for gender, age, hour, day of the week, and week of year fixed effects.

Note 3: Q-Values were estimated using a false discovery rate procedure following Simes (1986) and later refined by Benjamini and Hochberg (1995) and Benjamini and Yekutieli (2001).

The previous set of estimates aggregate all traffic stops across multiple departments and should be considered an average effect. Although the results from this section find a statistically significant disparity in the way that minority motorists are treated by Connecticut police even after we condition on the motivating reason for the traffic stop, they do not identify the sources of that disparity in terms of specific departments or officers. The results of a department-level analysis are presented in the next section and better identify the source of specific disparities.

VI.B: DEPARTMENT ANALYSIS OF STOP DISPOSITION, 2021

The analysis presented at the state-level shows that minority motorists are treated differently, in terms of disposition, relative to their non-Hispanic Caucasians counterparts, even when they are stopped for the same reason. By construction, the aggregate analysis does not investigate the source of these disparities in terms of specific municipal police departments or State Police troops. The analysis presented in this section seeks to better identify the sources of that disparity by running the same test for individual municipal departments and State Police troops. In this section, we estimate Equation 10 of Appendix A.6 separately for each municipal department and State Police troops. Thus, each set of estimates includes a vector of town-specific controls for the hour, day of the week, and department fixed effects. We identify all departments and State Police troops found to have a disparity that is statistically significant at the 95% level in either of the Hispanic or Black alone minority groups.

Ordinarily, we would present the results from estimating the test of equality in stop dispositions for minority motorists relative to their non-Hispanic Caucasians peers in individual policing agencies. However, no department was found to have a statistically significant disparity in post-stop outcomes in 2021 according to this test. The full set of results is contained in Table F.1 of Appendix F.

VII: ANALYSIS OF VEHICULAR SEARCHES

This section contains the results of an analysis of post-stop outcomes using a hit-rate approach following Knowles, Persico and Todd (2001). The hit-rate approach relies on the idea that motorists rationally adjust their propensity to carry contraband in response to their likelihood of being searched by police. Similarly, police officers rationally decide whether to search a motorist based on visible indicators of guilt and an expectation of the likelihood that a given motorist might have contraband. According to the model, we should expect the police to search a demographic group of motorists more often than Caucasians if they were also more likely to carry contraband. However, the higher level of searches should be exactly proportional to the higher propensity of this group to carry contraband. Thus, in the absence of racial animus, we should expect the rate of successful searches (i.e. the hit-rate) to be equal across different demographic groups regardless of differences in their propensity to carry contraband.[10]

In this test, discrimination is interpreted as a preference for searching minority motorists that shows up in the data as a statistically lower hit-rate relative to Caucasian motorists. In technical terms, the testable implication derived from this model is that the equilibrium search strategy, in the absence of group bias, will result in an equalization of the rate of contraband that is found relative to the total number of searches (i.e. the hit-rate) across motorist groups. In our application, we test for the presence of a disparity in the rate of successful searches using a nonparametric test, the Pearson X^2 test. Note that this test inherently says nothing about disparate treatment in the decision to stop motorists, as it is limited in scope to vehicular searches. Our primary analysis focuses on discretionary searches which we define as those identified as consent or probable cause searches and exclude inventory searches since those are likely correlated with other offenses and race. However, we primarily identify departments based on a robustness using only consent searches. Although there is a compelling case to be made that probable cause searches involve officer discretion, these searches aren't identified explicitly in the data and the category also includes plain view searches. Plain view searches have the potential to bias the results in the same way as inventory searches since they are likely correlated with other offenses and race.

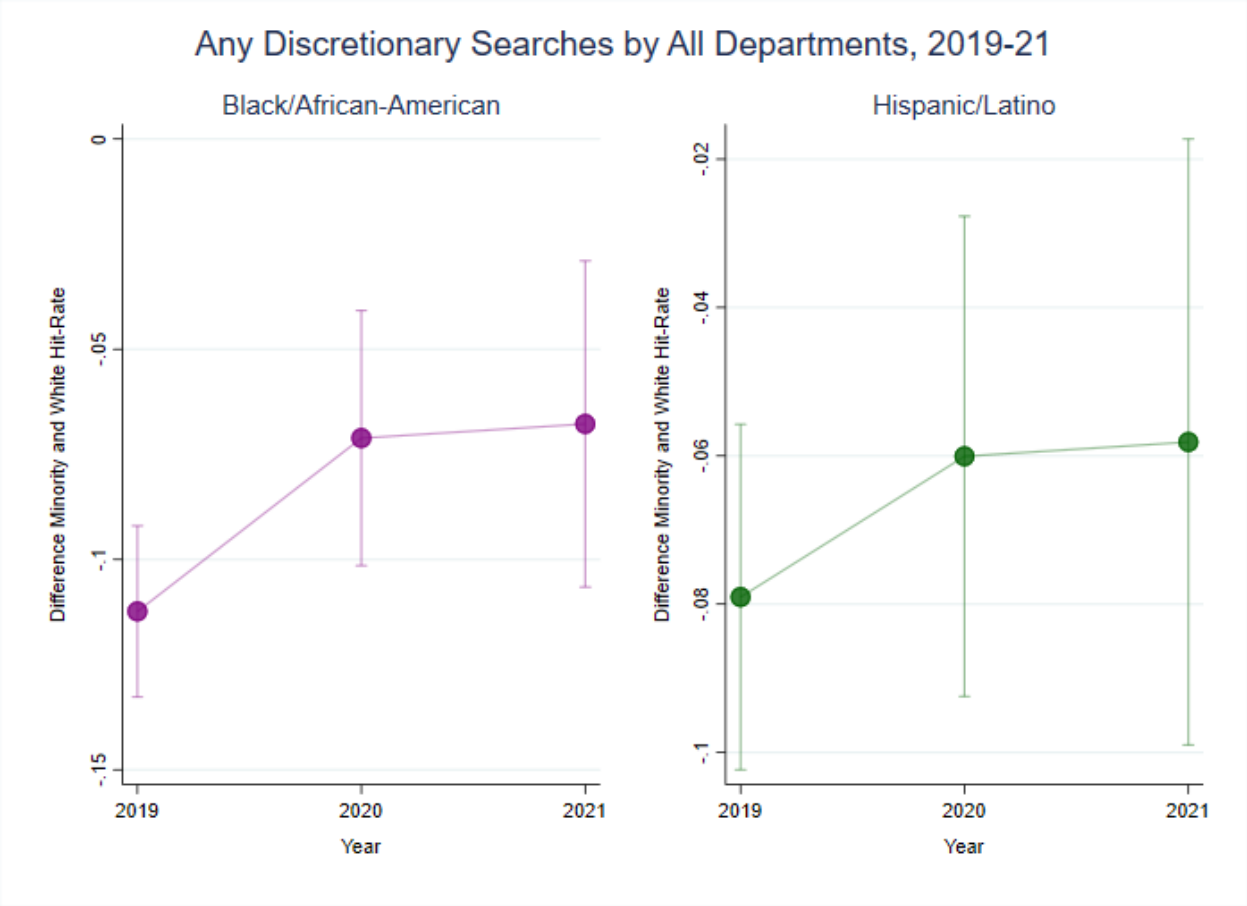
VII.A: AGGREGATE ANALYSIS WITH HIT-RATES, 2021 AND 2019-21

Figure 7.1 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of probable cause and consent searches in 2019, 2020, and 2021. The vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for discretionary searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21, the share of discretionary searches when contraband is found for Black motorists ranged from 37.79% to 45.08% and from 41.12% to 46.04% for Hispanic motorists. The hit-rate for both minority groups stood

[10] Although some criticism has risen concerning the technique and extensions have suggested that more disaggregated groupings of searches be used in the test, the ability to implement such improvements is limited by the small overall sample of searches in a single year of traffic stops. Despite these limitations, the hit-rate analysis is still widely applied in practice and contributes to the overall understanding of post-stop police behavior in Connecticut.

lower than that for non-Hispanic Caucasians motorists which ranged from 49.02% to 51.85% over the period. The difference in the rate of successful searches between both Black and Hispanic relative to non-Hispanic Caucasian motorists was negative and highly significant at the 99% level in every year. In general, the test consistently shows a disparity in the likelihood a minority motorist is searched by police in Connecticut which has gotten smaller but is relatively large in magnitude.

Figure 7. 1: **Aggregate Hit-Rate Analysis by Year, All Discretionary Searches 2019-21**



Notes: Coefficient estimates are obtained from Table 7.1 of the 2019 and 2020 annual report as well as the 2020 estimates from the table below.

Table 7.1 contains the results of the hit-rate test formally applied to all departments in Connecticut in 2021. As seen below, the rate of successful consent and probable cause searches for non-Hispanic Caucasians motorists was 51.85% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 45.11% to 46.04%. The difference in hit-rates for each group was statistically significant at the 99% level. In aggregate, Connecticut police departments are less successful when conducting searches of minority motorist relative to their majority peers which indicates potential adverse treatment towards minorities on the part of police.

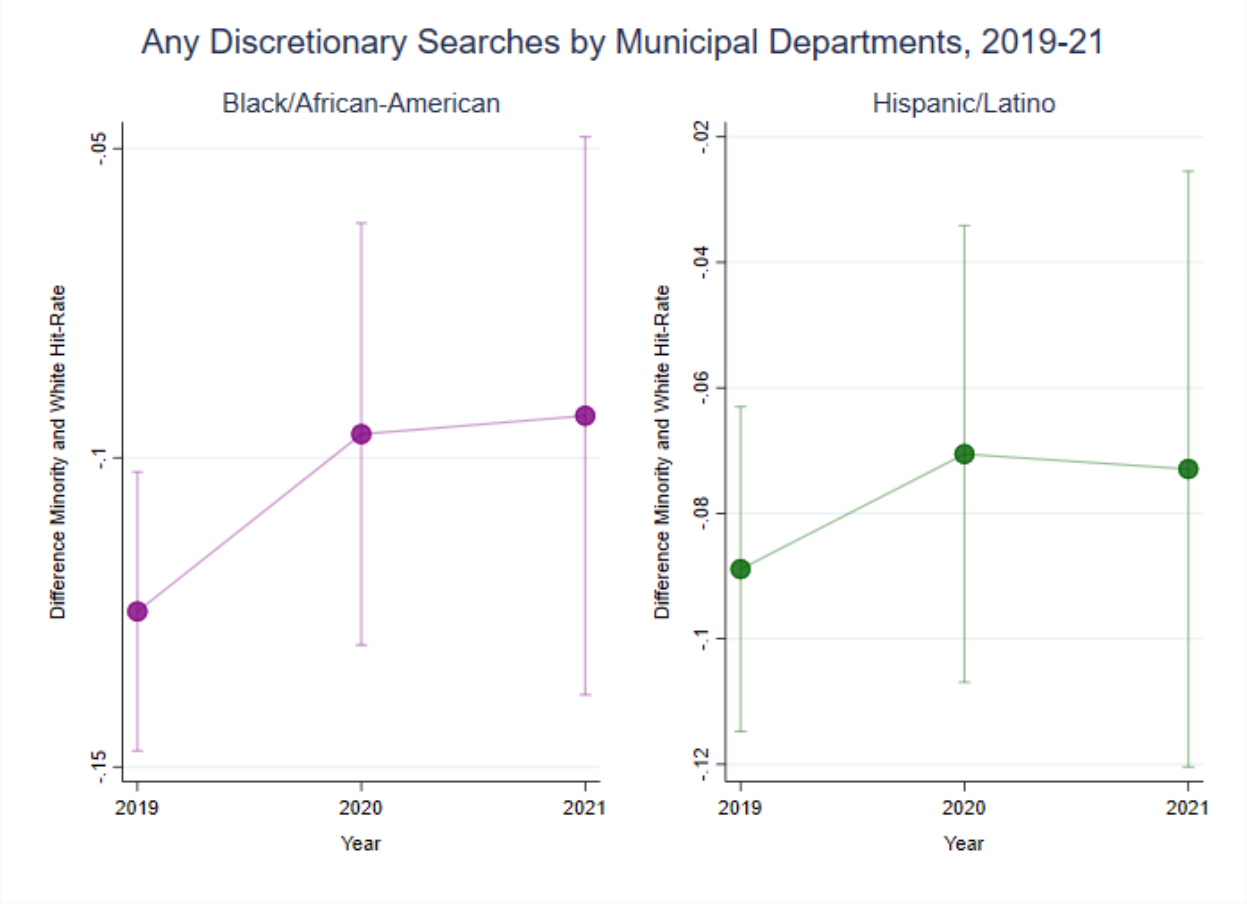
Table 7. 1: Chi-Square Test of Hit-Rate, All Discretionary Searches 2021

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	51.854%	45.293%***	45.112%***	46.041%***	45.679%***
Contraband	629	616	600	500	1073
Searches	1213	1360	1330	1086	2349
Chi^2	N/A	11.050	11.548	7.750	12.227
P-Value	N/A	0.001	0.001	0.004	0.001

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all consent and probable cause searches in 2021.

Figure 7.2 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of consent and probable cause searches for municipal departments in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for consent and probable cause searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21, the share of consent and probable cause searches when contraband is found for Black motorists ranged from 38.64% to 47.16% and from 42.23% to 49.19% for Hispanic motorists. The range in both minority hit-rates stood lower than that for non-Hispanic Caucasians motorists which ranged from 51.12% to 56.48% over the period. As with the aggregate results, the results for municipal departments indicate that searches of minority motorists are more likely to be unsuccessful relative to non-Hispanic Caucasian motorists. All of disparities were significantly different than zero at a level greater than 99% confidence. In general, the test consistently shows a disparity in the likelihood a minority motorist is searched by municipal police in Connecticut.

Figure 7. 2: Aggregate Hit-Rate Analysis by Year, Municipal Discretionary Searches 2019-21



Notes: Coefficient estimates are obtained from Table 7.2 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 7.2 contains the results of the hit-rate test formally applied to all municipal departments in Connecticut in 2021. As seen below, the rate of successful consent and probable cause searches for non-Hispanic Caucasians motorists was 56.56% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 47.23% to 49.26%. The difference in hit-rates for each group was statistically significant at the 99% level. In aggregate, Connecticut municipal police departments are less successful when conducting searches of minority motorist relative to their majority peers which indicates potential adverse treatment.

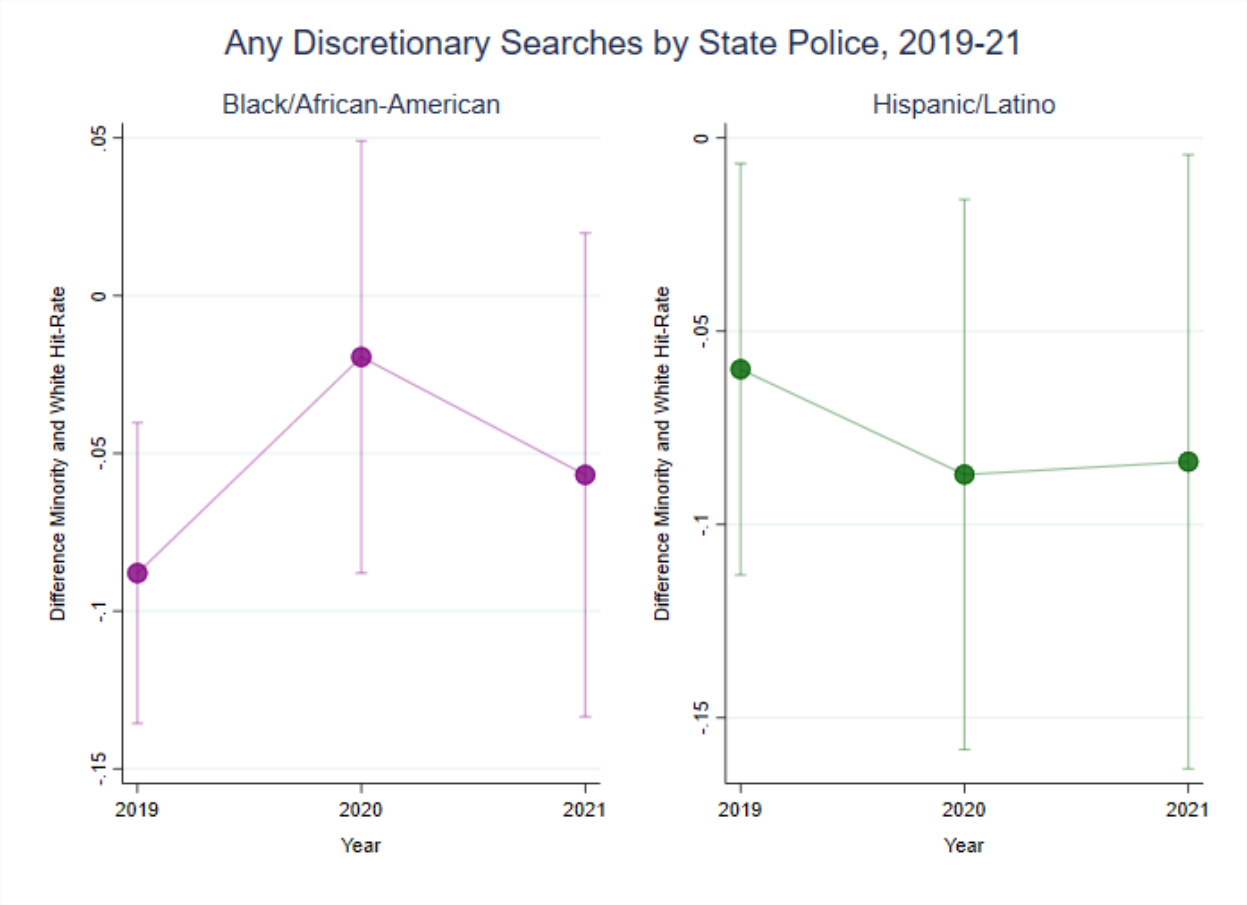
Table 7. 2: Chi-Square Test of Hit-Rate, Municipal Police Discretionary Searches 2021

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	56.562%	47.410%***	47.231%***	49.256%***	48.118%***
Contraband	474	522	512	431	921
Searches	838	1101	1084	875	1914
Chi2	N/A	15.953	16.471	9.168	16.625
P-Value	N/A	0.001	0.001	0.002	0.001

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all discretionary searches in 2021.

Figure 7.3 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of consent and probable cause searches by State Police in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for consent and probable cause searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21, the share of consent and probable cause searches when contraband is found for Black motorists ranged from 18.95% to 22.41% and from 22.40% to 23.97% for Hispanic motorists. The range in both minority hit rates was periodically lower than that for non-Hispanic Caucasians motorists which ranged from 30.11% to 42.50% over the period. The results for State Police indicate that searches of minority motorists were only more likely to be unsuccessful relative to non-Hispanic Caucasian for the majority of the years in the sample. The differences for these years and minority groups were significant at the 99% confidence level for all years except for Black motorists in 2020 and 2021.

Figure 7. 3: Aggregate Hit-Rate Analysis by Year, State Police Discretionary Searches 2019-21



Notes: Coefficient estimates are obtained from Table 7.3 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 7.3 contains the results of the hit-rate test formally applied to all State Police Troops in Connecticut in 2021. As seen below, the rate of successful searches for non-Hispanic Caucasians motorists was 41.44% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 32.99% to 34.07%. The difference in hit-rates was found to be statistically significant only for Hispanic motorists. In aggregate, Connecticut State Police are less successful when conducting searches of Hispanic motorist relative to their majority peers which indicates potential adverse treatment for that group in 2021.

Table 7.3: Chi-Square Test of Hit-Rate, State Police Discretionary Searches 2021

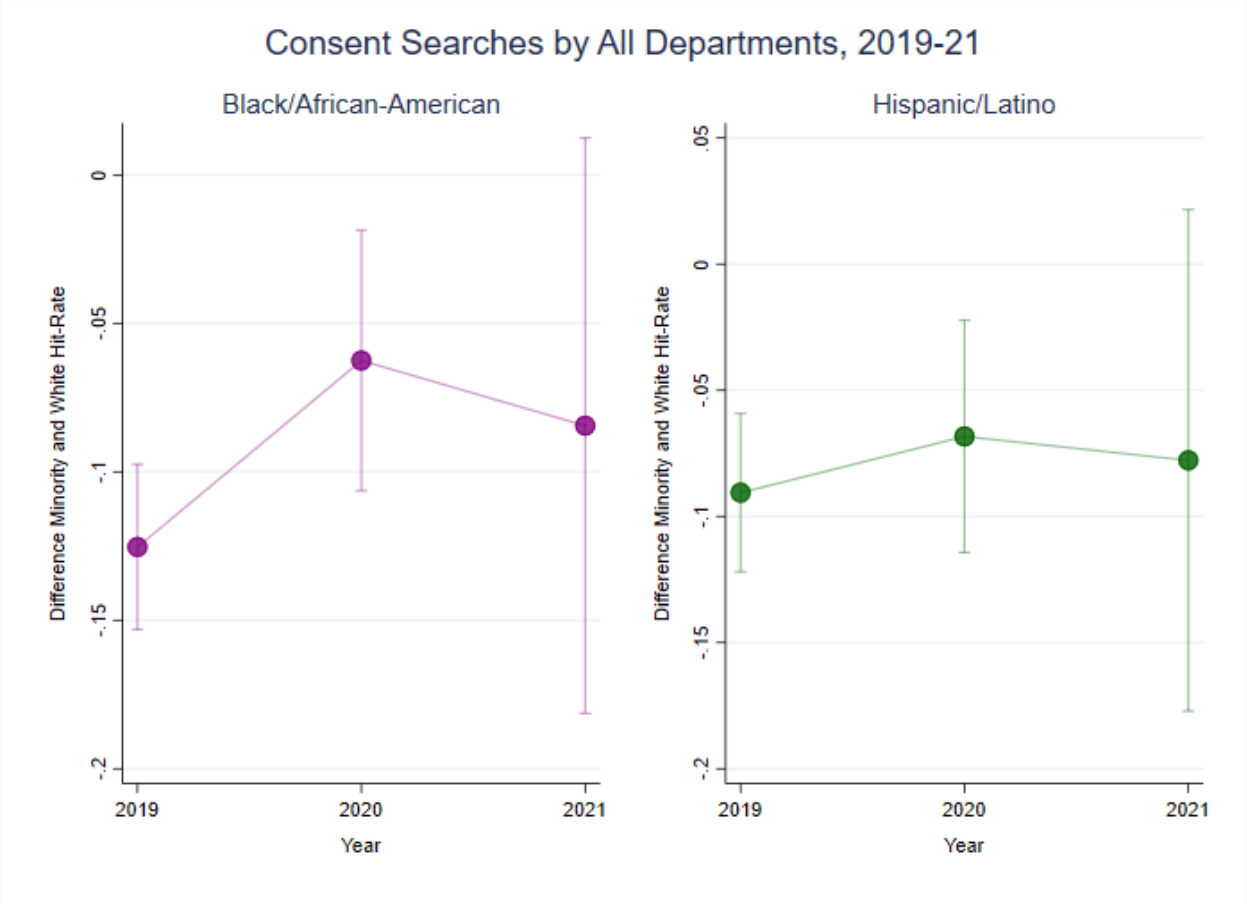
Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	41.444%	35.293%	34.710%*	32.701%**	34.339%**
Contraband	155	90	84	69	148
Searches	374	255	242	211	431
Chi2	N/A	2.411	2.805	4.362	4.307
P-Value	N/A	0.119	0.093	0.037	0.037

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all discretionary searches in 2021.

VII.B: AGGREGATE ROBUSTNESS CHECKS WITH DISCRETIONARY SEARCHES, 2021 AND 2019-21

This section presents a robustness check on the initial specification using a more restrictive subsample of only consent searches. As mentioned, the prior analysis which includes probable cause searches, is potentially biased against finding discrimination because these searches are not explicitly distinct in the data from plain view searches. Figure 14 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of consent searches in 2019, 2020, and 2021. The vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for consent searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21. The share of consent searches when contraband is found for Black motorists ranged from 19.19% to 25.23% and from 22.66% to 25.27% for Hispanic motorists. The range in both minority hit-rates stood lower than that for non-Hispanic Caucasians motorists which ranged from 29.25% to 31.69% over the period. The difference in the rate of successful searches between both Black and Hispanic relative to non-Hispanic Caucasian motorists was negative and highly significant at the 99% level in every year except 2021.

Figure 7. 4: Aggregate Hit-Rate Analysis by Year, Consent Searches 2019-21



Notes: Coefficient estimates are obtained from Table **7.1** of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 7.4 contains the results of the hit-rate test formally applied to all departments in Connecticut in 2021. As seen below, the rate of successful consent searches for non-Hispanic Caucasians motorists was 30.4% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 25.23% to 25.57%. The difference in hit-rates for each group was statistically significant at the 99% level. In aggregate, Connecticut police departments are less successful when conducting searches of minority motorist relative to their majority peers which indicates potentially adverse treatment on the part of police. However, these differences were statistically indistinguishable from zero.

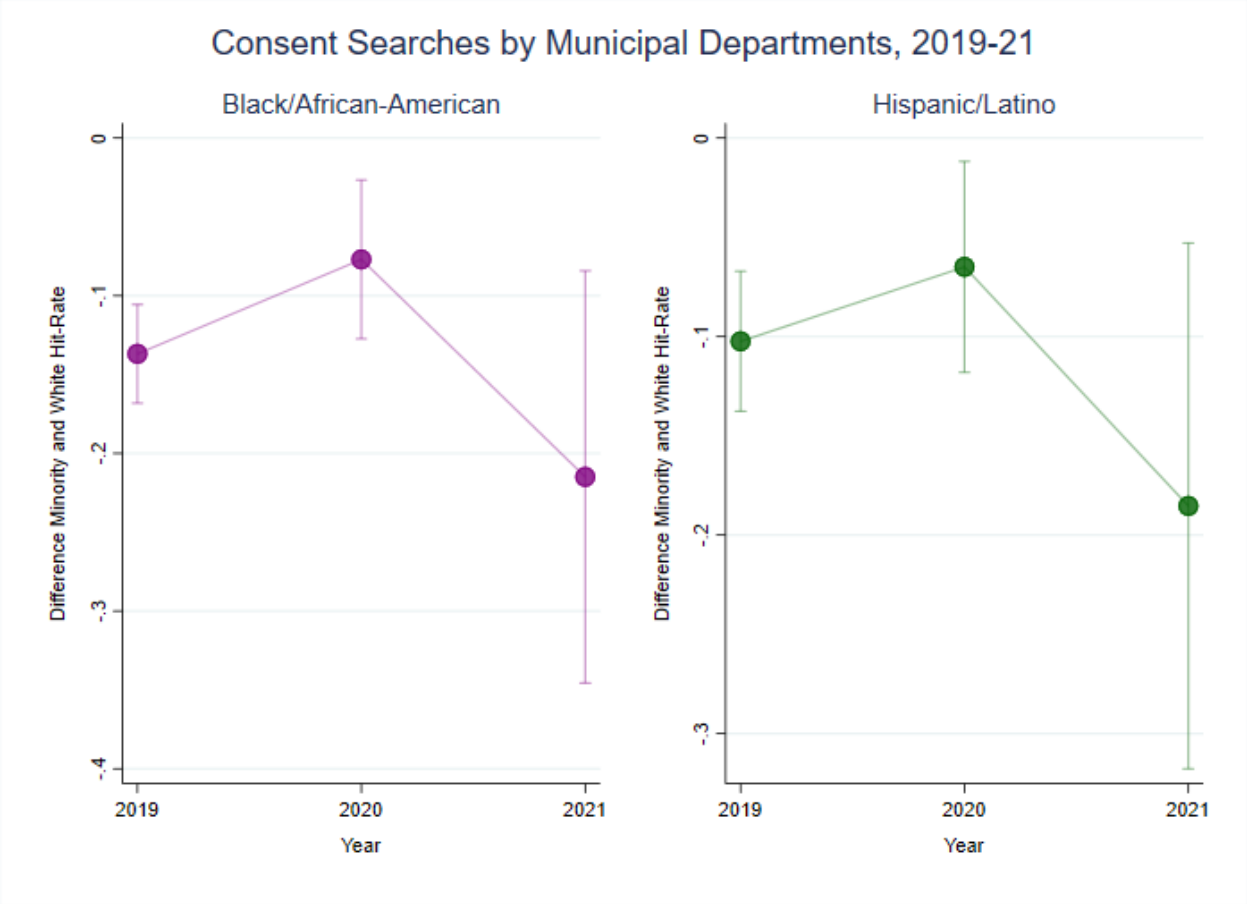
Table 7. 4: Chi-Square Test of Hit-Rate, Consent Searches 2021

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	32.467%	24.044%*	24.021%*	24.690%	24.551%*
Contraband	50	44	43	40	82
Searches	154	183	179	162	334
Chi^2	N/A	2.950	2.933	2.344	3.348
P-Value	N/A	0.086	0.086	0.126	0.067

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all consent searches in 2021.

Figure 7.5 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of consent searches for municipal departments in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for consent searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21. The share of consent searches when contraband is found for Black motorists ranged from 18.55% to 22.44% and from 21.85% to 24.80% for Hispanic motorists. The range in both minority hit-rates stood dramatically lower than that for non-Hispanic Caucasians motorists which ranged from 29.70% to 44.71% over the period. As with the aggregate state level results, the results for municipal departments indicate that searches of minority motorists are more likely to be unsuccessful relative to non-Hispanic Caucasian motorists. All of disparities were significantly different than zero at a level greater than 99% confidence. In general, the test consistently shows a disparity in the likelihood a minority motorist is searched by municipal police in Connecticut.

Figure 7. 5: Aggregate Hit-Rate Analysis by Year, Municipal Consent Searches 2019-21



Notes: Coefficient estimates are obtained from Table 7.5 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 7.5 contains the results of the hit-rate test formally applied to all municipal departments in Connecticut in 2021. As seen below, the rate of successful consent searches for non-Hispanic Caucasians motorists was 44.71% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 20.325% to 20.49%. The difference in hit-rates for each group was statistically significant at the 99% level. In aggregate, Connecticut municipal police departments are less successful when conducting searches of minority motorist relative to their majority peers which indicates potential adverse treatment.

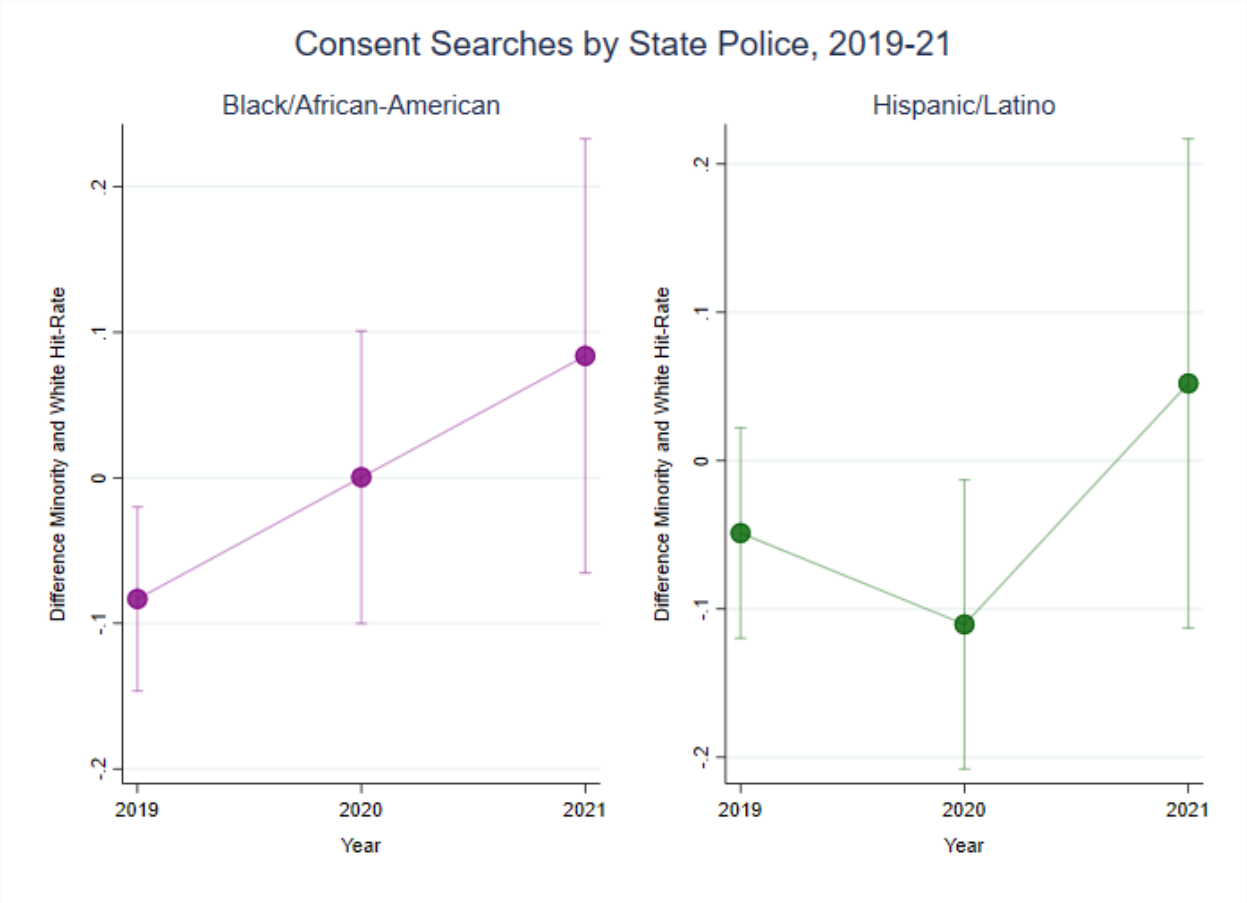
Table 7. 5: Chi-Square Test of Hit-Rate, Municipal Consent Searches 2021

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	43.209%	20.492%***	20.660%***	24.389%***	22.726%***
Contraband	35	25	25	30	55
Searches	81	122	121	123	242
Chi^2	N/A	12.067	11.814	7.967	12.666
P-Value	N/A	0.001	0.001	0.004	0.001

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all consent searches in 2021.

Figure 7.6 presents a confidence interval between the difference in the hit-rate for Black (left panel) and Hispanic (right panel) motorists using data on the outcome of consent searches by State Police in 2019, 2020, and 2021. As before, the vertical axis on the figure plots a 95% confidence interval around differences in the rate at which contraband is found for consent searches of minority motorists relative to non-Hispanic Caucasian motorists. A negative difference indicates that minorities are searched disproportionately often relative to the rate at which police actually find contraband when compared with their majority peers. Across the period 2019-21, the share of consent searches when contraband is found for Black motorists ranged from 20.50% to 30.00% and from 17.24% to 26.83% for Hispanic motorists. The range in both minority hit rates was periodically lower than that for non-Hispanic Caucasians motorists which ranged from 21.62% to 28.82% over the period. The results for State Police indicate that searches of minority motorists were only more likely to be unsuccessful relative to non-Hispanic Caucasian motorists in 2019 (Black) and 2020 (Hispanic). The differences for these years and minority groups were significant at the 99% confidence level while the remaining estimates were statistically indistinguishable from zero.

Figure 7. 6: Aggregate Hit-Rate Analysis by Year, State Police Consent Searches 2019-21



Notes: Coefficient estimates are obtained from Table 7.6 of the 2019 and 2020 annual report as well as the 2021 estimates from the table below.

Table 7.6 contains the results of the hit-rate test formally applied to State Police Troops in Connecticut in 2021. As seen below, the rate of successful consent searches for non-Hispanic Caucasians motorists was 20.54% in 2021. Relative to non-Hispanic Caucasians motorists, the hit-rate for each of the four minority subgroups was lower and ranged from 25.64% to 30.00%. The difference between each of the minority hit rates and that of non-Hispanic Caucasians was statistically indistinguishable from zero.

Table 7. 6: Chi-Square Test of Hit-Rate, State Police Consent Searches 2021

Variable	Caucasian	Non-Caucasian	Black	Hispanic	Black or Hispanic
Hit Rate	20.548%	30%	29.825%	25.641%	28.570%
Contraband	15	18	17	10	26
Searches	73	60	57	39	91
Chi^2	N/A	1.577	1.483	0.379	1.391
P-Value	N/A	0.209	0.223	0.537	0.238

Notes: The coefficients are presented along with robust standard errors. A coefficient concatenated with * represents a p-value of .1, ** represents a p-value of .05, and *** represents a p-value of .01 significance. Sample includes all consent searches in 2021.

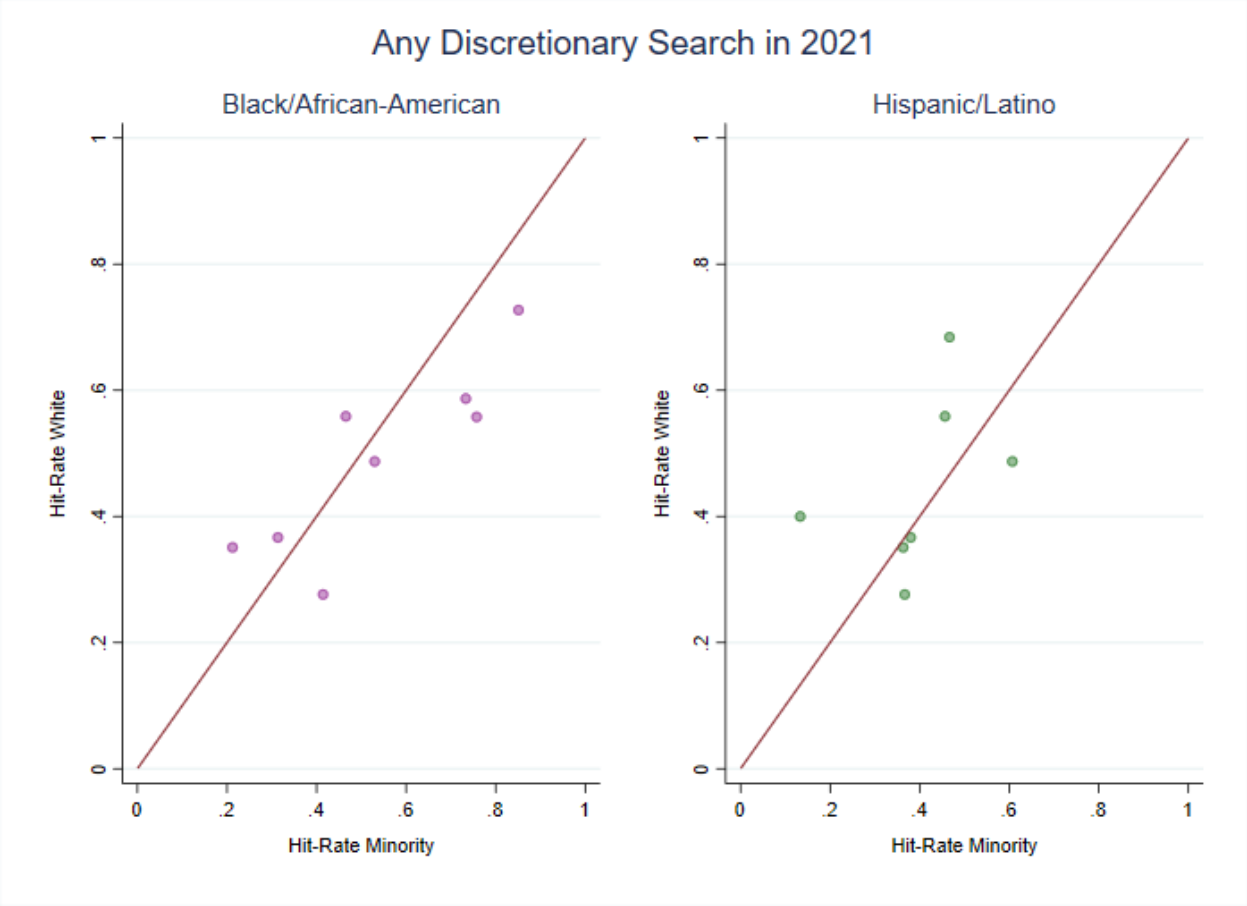
VII.C: DEPARTMENT ANALYSIS WITH HIT-RATES, 2021 AND 2019-21

The analysis presented for Connecticut police as a whole showed that the likelihood a police search of a minority results in contraband being found is significantly lower relative to searches of their non-minority peers. In this subsection, differences in hit-rates are estimated independently for each municipal department and State Police troop. We graphically present estimate of the hit-rate test separately for each municipal department and State Police troop. We first provide results for the 2021 sample of the data as we have done in the prior three reports. However, we also leverage the full three-year sample from 2019-21 and graphically present estimates of the effect of daylight for smaller departments which previously had an insufficiently small sample to run the test annually. In this test, it is necessary to restrict the sample to only motorists stopped and subsequently searched by police. However, this restriction significantly reduces the estimation power in small samples. In the figures and discussion below, we highlight only the departments found to have a statistically significant disparity in the Black or Hispanic alone categories for either the 2021 or combined 2019-21 samples. Identification requires that departments and State Police troops have a disparity that is statistically significant at or above the 95% level in either of the Hispanic or Black alone minority groups. Further, we only highlight departments that have a false discovery rate below 10% in both specifications. We provide the full set of results in Tables G.1, G.2, G.3, and G.4 of Appendix G.

Figure 7.7 plots the likelihood a Black (left panel) or Hispanic (right panel) motorist is searched by police relative to their non-Hispanic Caucasian peers. Individual points on the figure represent specific municipal departments and State Police troops. The vertical axis plots the likelihood that a discretionary search of a non-Hispanic Caucasian motorist results in contraband being found and the horizontal axis plots the same likelihood for minority motorists. The red 45-degree line represents parity (equal treatment) between police searches of minorities and non-Hispanic Caucasians. Thus, only departments falling above this line (top left quadrant) are more likely to search minority motorists relative to non-minorities. We annotate only those departments where the difference is

statistically significant at or above the 95% confidence level in the main specification and with a false discovery rate below 10%. The full results are contained in Table G.1 of Appendix G. Applying this test to the 2021 data, we do not identify any departments but note that Hartford appeared as having marginally significant results for Black motorists.

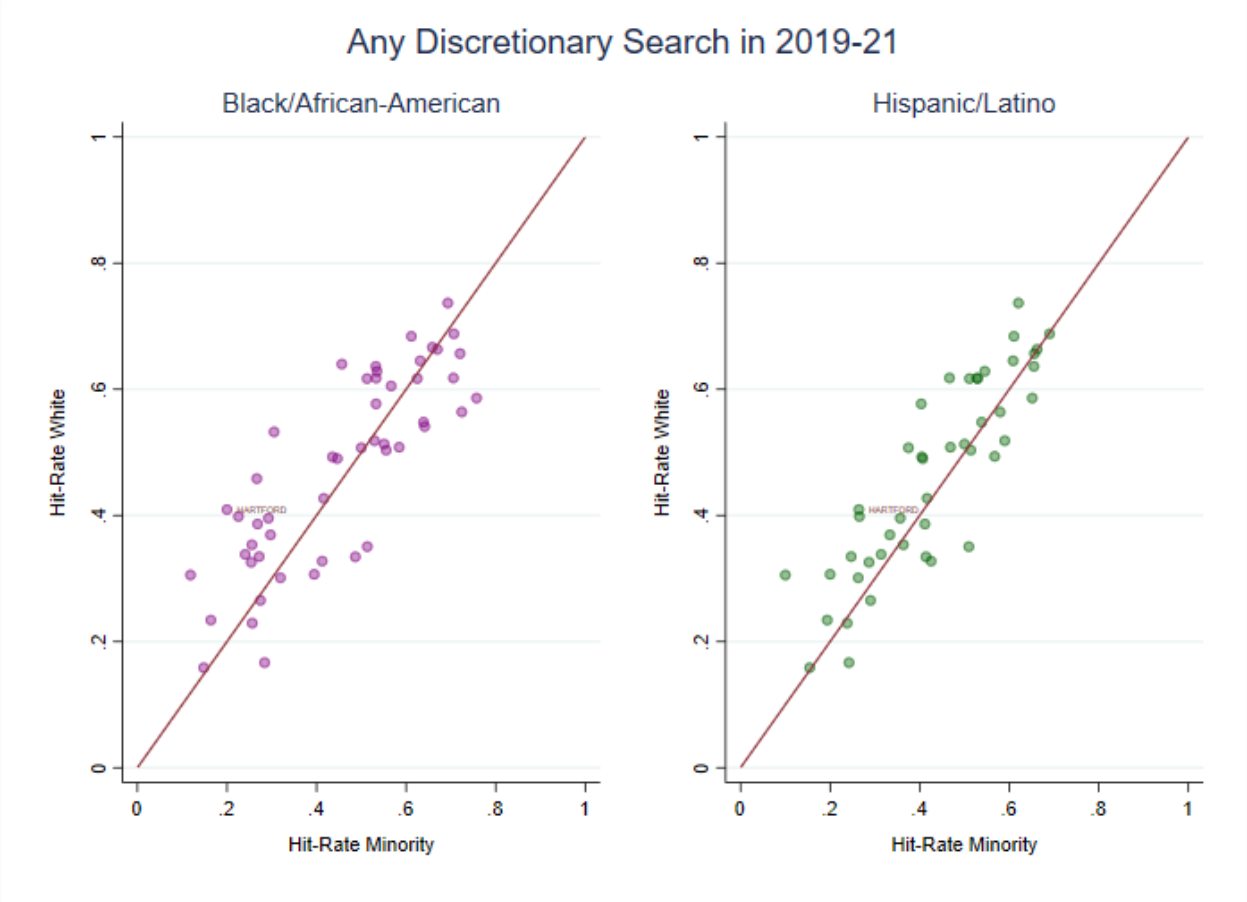
Figure 7. 7: Hit Rate Analysis by Department, All Discretionary Searches 2021



Notes: Hit-rates are obtained from Table G.1 of Appendix G. Annotated departments include only those with a statistically significant disparity estimated non-parametrically with a confidence level at or exceeding the 95% in the combined sample of discretionary searches. Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

As discussed, there are too few searches for this test to be applied to a single year of data for many small departments. Thus, Figure 7.8 plots the likelihood a Black (left panel) or Hispanic (right panel) motorist is searched by police relative to their non-Hispanic Caucasian peers in a combined three-year sample. The full results are contained in Table G.2 of Appendix G. Applying this test to the 2019-21 data, we only identify Hartford (Black & Hispanic) with a significance level exceeding 95% confidence and a false discovery rate below 10%. We also note that Waterbury (Black & Hispanic) was identified in the combined sample of consent and probable cause searches but not in the robustness test which restricted the sample to only consent searches.

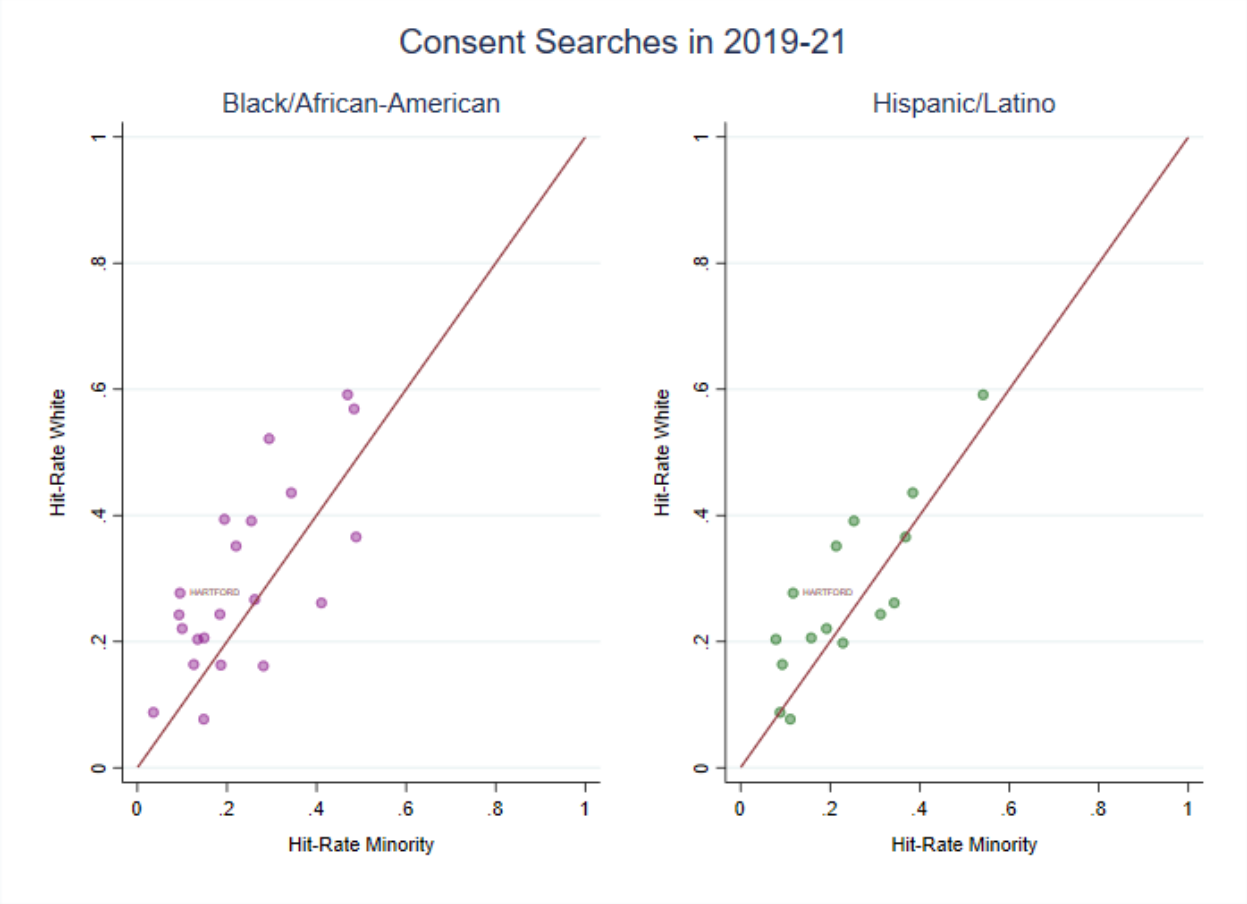
Figure 7. 8: Hit Rate Analysis by Department, All Discretionary Searches 2019-21



Notes: Hit-rates are obtained from Table G.2 of Appendix G. Annotated departments include only those with a statistically significant disparity estimated non-parametrically with a confidence level at or exceeding the 95% in the combined sample of discretionary searches. Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

Ordinarily, we would plot the likelihood a Black or Hispanic motorist is searched, consent only, by police relative to their non-Hispanic Caucasian peers. However, there was not a large enough sample in any department during 2021 to estimate a hit-rate on this subsample of searches. However, Figure 7.9 plots the likelihood a Black (left panel) or Hispanic (right panel) motorist is searched (consent only) by police relative to their non-Hispanic Caucasian peers. Individual points on the figure represent specific municipal departments and State Police troops. The full results are contained in Table G.4 of Appendix G. Applying this test to the 2019-21 data, we identify Hartford (Black & Hispanic) as being statistically less likely to find contraband when searching minority relative to non-Hispanic Caucasian motorists. The results for Hartford were statistically significant at a level exceeding 95% confidence and had a false discovery rate below 10%.

Figure 7. 9: Hit Rate Analysis by Department, Consent Searches 2019-21



Notes: Hit-rates are obtained from Table G.4 of Appendix G. Annotated departments include only those with a statistically significant disparity estimated non-parametrically with a confidence level at or exceeding the 95% in the combined sample of discretionary searches. Identified departments also had a false discovery rate below 10% estimated following Simes (1986), Benjamini and Hochberg (1995), and Benjamini and Yekutieli (2001).

VIII: FINDINGS FROM THE 2021 AND 2019-21 ANALYSIS

This section represents a summary of the findings from both the annual analysis of traffic stops conducted between January 1, 2021 and December 31, 2021 and the 2019 to 2021 three-year aggregate analysis between January 1, 2019 and December 31, 2021.

VIII.A: AGGREGATE FINDINGS FOR CONNECTICUT, 2021 AND 2019-21

Municipal and State Police departments in Connecticut made 274,432 traffic stops in 2021 (1,029,511 in 2019-21) of which 61% were of White non-Hispanic motorists while 19% were Black and 18% were of Hispanic motorists. Recorded traffic stops increased by 13% in 2021 compared to 2020 but remained 46% lower than 2019. State police saw a further decline in recorded traffic stops in 2021 with a 3.5% decrease compared to 2020 and a remain 53% lower than 2019. Municipal police increased recorded traffic stops by 18% in 2021 compared to 2020, but still remain 43% lower than 2019.

At the aggregate level, we present estimates from applying the veil of darkness analysis, a search hit-rate analysis, and a post-stop disposition analysis. The veil of darkness analysis exploits quasi-random variation in the timing of sunset to identify potential discrimination in the decision to stop a motorist. According to the results from applying this test, the estimated change from daylight to darkness in the odds a stopped motorist is a Black was 0.97 in 2019 and 2020 but 0.98 in 2021. The change from daylight to darkness in the odds a stopped motorist is Hispanic was 1.06 in 2019 but 1.04 in 2020 and 2021. The key identifying assumption of this test is that police officers who are inclined to racially profile motorists are better able to do so during daylight when motorist race is more easily observed prior to making a traffic stop. According to this logic and the application of the test to the 2021 traffic stop data, Connecticut police were not any more likely to stop Black or Hispanic motorists.

In 2021, Municipal and State Police departments in Connecticut also conducted a total of only 7,365 (2.75%) motor vehicle searches of which 32% were of non-Hispanic Caucasian motorists while 37 % were of Black and 30% were of Hispanic motorists. At the aggregate level, we present estimates comparing the likelihood a search resulted in contraband being found for non-Hispanic Caucasian motorists relative to minority motorists. In addition, we compare the disposition of traffic stops across these groups after conditioning on the motivating reason for the traffic stop. The rate at which discretionary searches of non-Hispanic Caucasian motorists yielded contraband was 49% in 2019, 50% in 2020, and 52% in 2021. The rate at which searches of Black and Hispanic motorists yielded contraband was 38% and 41% respectively in 2019, 42% and 44% respectively in 2020, and 45% and 46% respectively in 2021. The key identifying assumption of this test is that, if police are unbiased, they will only search minority motorists more often than whites relative to their expected likelihood of carrying contraband. The lower hit-rate for minority motorists is suggestive of potential bias on the part of police. The stop disposition analysis did not reveal any discernible pattern in terms of how minority motorists are treated following a traffic stop but did indicate that they faced statistically different outcomes.

VIII.B: VEIL OF DARKNESS ANALYSIS FINDINGS, 2021 AND 2019-21

In an effort to better identify the source of these racial and ethnic disparities, each analysis was repeated at the department level for both the 2021 calendar year and the 2019 to 2021 aggregate sample. The threshold for identifying individual departments was the presence of a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories.[11] By construction, the departments that were identified as having a statistically significant disparity are the largest contributors to the overall statewide results. Here, the unit of analysis is a municipal department or State Police Troop where disparities could be a function of a number of factors including institutional culture, departmental policy, or individual officers.[12]

In total, we identify three State Police Troops in the three-year aggregate sample. State Police Headquarters and Troop D were also identified in our 2020 analysis. We also identified one municipal police departments in the three-year aggregate sample. The municipal police department has been identified in several previous annual studies across multiple measures. For all departments identified in this report, we conclude that there is strong evidence that a disparity exists in the rate of minority traffic stops made during daylight conditions. These departments include:

State Police Headquarters

State Police Headquarters was identified on the veil of darkness analysis in 2019-21 sample for both Black and Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black or Hispanic totaled 0.24 and 0.25 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black or Hispanic grew to 0.34 and 0.31 during daylight when we presume that police are better able to detect race.

State Police Troop D

State Police Troop D was identified on the veil of darkness analysis in 2019-21 sample for Black motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black totaled 0.07 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black grew to 0.10 during daylight when we presume that police are better able to detect race.

State Police Troop H

State Police Troop H was identified on the veil of darkness analysis in 2019-21 sample for Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility

[11] Put simply, there must have been at least a 95 percent chance that the motorists were more likely to be stopped at a higher rate relative to white Non-Hispanic motorists.

[12] Since department or state police barrack estimates represent an average effect of stops made by individual officers weighted by the number of stops that they made in 2018, it is possible that officer-level disparities exist in departments which were not identified.

to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Hispanic totaled 0.36 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Hispanic grew to 0.48 during daylight when we presume that police are better able to detect race.

Wethersfield:

Wethersfield was identified on the veil of darkness analysis in 2019-21 sample for both Black and Hispanic motorists. The veil of darkness analysis exploits quasi-random variation in visibility to identify potential discrimination controlling for day of week and time of day. During the sample window for this test, the odds a stopped motorist was Black or Hispanic totaled 0.26 and 0.45 in darkness when we presume that police are less able to detect the race of a motorist prior to making a traffic stop. Conditioning on day of the week and time of day, the odds a stopped motorist was Black or Hispanic grew to 0.38 and 0.56 during daylight when we presume that police are better able to detect race.

VIII.C: OTHER STATISTICAL AND DESCRIPTIVE MEASURE FINDINGS, 2021 AND 2019-21

In addition to the three State Police troops and one municipal police department identified to exhibit statistically significant racial or ethnic disparities in the Veil of Darkness analysis, a number of other departments were identified using either the descriptive tests, stop disposition test or KPT hit-rate analysis. These additional tests are designed as an additional screening tool to identify the jurisdictions where consistent disparities exceed certain thresholds that appear in the data. Although it is understood that certain assumptions have been made in the design of each of these measures, it is reasonable to believe that departments with consistent data disparities that separate them from the majority of other departments should be subject to further review and analysis with respect to the factors that may be causing these differences.

Synthetic Control Analysis:

The results from estimating whether individual departments stopped more minority motorists relative to their requisite synthetic control found 28 municipal police departments, and 3 State Police troops to have a disparity that was statistically significant at the 95 percent level in the Black or Hispanic alone categories and withstood doubly-robust estimation, and had a false discovery rate below 10%. *Brookfield, Troop H, East Haven, Farmington, Meriden, New London, North Haven, Orange, Wallingford, Waterford, Watertown,* and *Wethersfield* were identified in the 2021 sample and the aggregate 2019 to 2021 sample. *Avon, Bridgeport, Cheshire, Troop K, Hamden, New Canaan, Stratford,* and *Windsor Locks* were identified only in the 2021 sample. Lastly, *Troop I, Derby, Granby, Monroe, New Haven, Newington, Plainville, Plymouth, Stonington, Wilton,* and *Wolcott* were identified only in the three-year aggregate analysis.

Descriptive Statistics Analysis:

The descriptive tests are designed as an additional tool to identify disparities that exceed certain thresholds that appear in a series of census-based benchmarks. The two descriptive benchmarks

used are: (1) statewide average and (2) resident-only stops. Although 55 municipal police departments were identified with racial and ethnic disparities when compared to one or more of the descriptive measures, only *Naugatuck, New Britain, Derby, Stratford, Enfield, Newington, and Vernon* exceeded the disparity threshold in both measures with a score more than half the benchmark total.

Stop Disposition Analysis:

In contrast to prior years, we find no discernible pattern that minority motorists are treated differently in any unform way relative to their non-Hispanic Caucasians counterparts. There were no departments found to have a statistically significant disparity in post-stop outcomes in 2021.

KPT Hit-Rate Analysis:

The results of this test, applied to the aggregate search data for all departments in Connecticut show that departments are less successful in motorist searches across all minority groups, which is a potential indicator of disparate treatment. There was no municipal police departments or State Police Troops found to have a disparity in the hit-rate of minority motorists relative to White non-Hispanics motorists for the 2021 sample. In the combined 2019-21 aggregate sample, there was one municipal police department found to have a disparity in the hit-rate of minority motorists relative to White non-Hispanic motorists. The one municipal department identified to exhibit a statistically significant racial or ethnic disparity in searches were:

Hartford:

Hartford was identified on the search hit-rate analysis in the combined 2019-21 sample for both Black and Hispanic motorists. This analysis compares the rate at which searched minority motorists are actually found with contraband to the same majority rate. In the data, contraband was found in only 20% of Black and 26% of Hispanic discretionary searches. Relative to the 41% of non-Hispanic Caucasian motorists, searches of minority motorists were less successful and suggestive of potential adverse treatment.

VIII.D: FOLLOW-UP ANALYSIS

The entirety of chapters III through VII of this report should be utilized as a screening tool by which researchers, law enforcement administrators, community members and other appropriate stakeholders focus resources on those departments displaying the greatest level of disparities in their respective stop data. As noted previously, racial and ethnic disparities in any traffic stop analysis do not, by themselves, provide conclusive evidence of racial profiling. Statistical disparities do, however, provide significant evidence of the presence of idiosyncratic data trends that warrant further analysis.

In order to determine if a departments racial and ethnic disparities warrant additional in-depth analysis, researchers review the results from some of the analytical sections of the report. The threshold for identifying significant racial and ethnic disparities for departments is described in each section of the report (ex. departments with a disparity that was statistically significant at the 95 percent level in the black or Hispanic alone categories in the Veil of Darkness methodology were identified as statistically significant). A department is identified for a follow-up analysis if they meet any one of the following criteria:

3. A statistically significant disparity in the one-year or three-year Veil of Darkness analysis
4. A statistically significant disparity in the one-year or three-year KPT hit rate and Stop Disposition analyses

It is worth noting that past reports have relied on results from the Synthetic Control method and Descriptive Statistics to identify departments for additional analysis. Although results from those methods are provided in the report, the authors believe that since 2010 census information forms much of the foundation of these measures, it would be better appropriate to limit the use of these tests until 2020 census data has been fully incorporated into the analysis. The authors also believe that the inclusion of a three-year aggregate analysis significantly improves our ability to utilize the more sophisticated statistical techniques, especially on departments with small annual sample sizes. Improvements have also been made to the post-stop measures to make them more rigorous and statistically sound.

In general, we continue to identify far fewer departments in this report relative to the previous year's studies with only one municipal department and three State Police troops. The municipal department and three State Police Troops were identified in the three-year aggregate sample only. Although the municipal police department and three State Police troops meet the criteria for an in-depth follow-up analysis, we are not recommending any be conducted at this time.

The **Wethersfield** police department has been identified with statistically significant disparities in this study and several previous studies. Since 2015, the project staff have conducted three follow-up analyses to understand better the factors contributing to racial and ethnic disparities in Wethersfield. In this study, the department's statistically significant disparity only appeared in the three-year aggregate analysis and was not identified when researchers analyzed 2020 and 2021 alone. It is evident that the 2019 data is significantly contributing to the disparity highlighted in the three-year aggregate analysis. A new police chief, who revised the command staff, was brought in by town officials in 2021 to address this and other issues within the department. Based on conversations with the agency, we believe reforms have been and continue to be implemented that will address the disparities outlined in this report. Therefore, it is reasonable that any changes made by the department would not be reflected in their data until 2022 and 2023. Since the three-year aggregate analysis covers a significant portion of time prior to changes in leadership, it is unsurprising that the department would continue to show statistically significant racial and ethnic disparities. We will continue monitoring the department's data to assess changes in their racial and ethnic disparities in more recent years.

The report also identified **State Police Headquarters**, **Troop D**, and **Troop H** with statistically significant racial and ethnic disparities. All three troops were identified in the three-year aggregate analysis but were not identified in the analysis of only 2021 data. Prior to the publication of this report, the project staff discovered substantial data discrepancies with state police infraction records submitted to the racial profiling database between 2014 and 2021. In June 2023, the project released a comprehensive audit outlining the findings. In order to more fully evaluate and resolve the discrepancies highlighted in the 2023 audit, the project staff decided not to conduct a follow-up analysis of any state police troop barracks at this time.

Lastly, in addition to being identified with racial and ethnic search disparities in this study, the **Hartford** police department was identified with racial and ethnic search disparities in the 2020

Traffic Stop Data Analysis and Findings report. The large and consistent nature of these disparities warrant additional analysis of search records by Hartford.

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