UNITED STATES DISTRICT COURT
EASTERN DIVISION OF WISCONSIN
MILWAUKEE DIVISION

Charles Collins, *et al.*, Plaintiff, v. The City of Milwaukee, *et al.*, Defendants.	Case No. 17-CV-00234-JPS

Report of David Abrams, Ph.D.

February 20, 2018

TABLE OF CONTENTS

I. INTRODUCTION 1

A. Qualifications and Professional Experience 1

B. Materials Relied Upon 1

II. ALLEGATIONS AND ASSIGNMENT 2

A. Allegations 2

B. Assignment 3

III. PARTIES TO THE LITIGATION 3

IV. SUMMARY OF CONCLUSIONS 4

V. BACKGROUND 5

A. The Residents of Milwaukee 5

B. Traffic and Pedestrian Stops in Milwaukee 7

C. The Milwaukee Police Districts 8

D. Data Limitations 10

VI. TRAFFIC STOP ANALYSIS 12

A. The Data on Traffic Stops Produced by the Defendants 13

B. Traffic Stops in Milwaukee are Concentrated in Predominately Black and Latino Districts 16

C. Black and Latino Drivers Are More Likely than White Drivers to be Stopped Across Milwaukee and in Each Milwaukee Police District 17

D. Traffic Stop Regression Analyses 18

E. Contraband Discovery During Traffic Stops 21

i. Contraband is Discovered at Low Rates Overall, and at Even Lower Rates for Black and Latino Drivers 21

ii. Statistical Analysis of Contraband Discovery 23

F. Black and Latino Drivers are Searched at Higher Rates than White Drivers 25

VII. MILWAUKEE POLICE ISSUE SPEEDING CITATIONS WITH HIGHER PENALTIES TO BLACK AND LATINO DRIVERS 28

A. MPD Data on Speeding Citations 29

B. Schedule of Penalties for Speeding 30

C. Tickets Issued to Black and Latino Drivers Are Less Likely to Be for Lenient Speeds 30

D. Racial and Ethnic Disparities in Officer Exercise of Leniency in Speeding Tickets Persist After Accounting for Differences in Driver Characteristics, Speed Limit, Time of Stop, and MPD District 33

VIII. REASONABLE SUSPICION ANALYSIS 34

IX. PEDESTRIAN STOP ANALYSIS 37

A. Pedestrian Stops in Milwaukee are Concentrated in Predominately Black and Latino Neighborhoods 39

B. Black Pedestrians Are More Likely to be Stopped Than White Pedestrians in All Districts 39

C. Pedestrian Stop Regression Analyses 40

X. CONCLUSIONS 41

APPENDICES

A. CURRICULUM VITAE……..A-1

B. MATERIALS RELIED UPON……...B-1

C. CONSTRUCTION OF VARIABLES USED FOR ANALYSIS……..C-1

D. ADDITIONAL TABLES……D-1

Exhibit D-1: Summary of Variables in Traffic Stop Rate Analysis……...D-2

Exhibit D-2: Estimation Results: Traffic Stop Rate……....D-3

Exhibit D-3: Summary of Variables in Analyses of the Rate of Contraband Discovery in Traffic Stop Searches……..…...….D-4

Exhibit D-4: Summary of Variables in Analysis of Traffic Stop Search Rate……..D-5

Exhibit D-5: Estimation Results: Traffic Stop Search Rate with District-Specific Race Effects…….……D-6

Exhibit D-6: Summary of Variables in Speeding Analysis…….D-8

Exhibit D-7: Probability of Being Charged at Lenient Speeds……..…D-9

Exhibit D-8: Summary of Variables in Pedestrian Stop Rate Analysis……..…..D-10

Exhibit D-9: Estimation Results: Pedestrian Stop Rate…….....D-11

I. INTRODUCTION

A. Qualifications and Professional Experience

1. My name is David Abrams, and I am a Professor of Law, Business Economics, and Public Policy at the University of Pennsylvania Law School and Professor of Business Economics and Public Policy at The Wharton School. I received my A.B. in Physics from Harvard University in 1998, my M.S. in Physics from Stanford University in 2001 and my Ph.D. in Economics from the Massachusetts Institute of Technology in 2006. I am a Board Member and past President of the Society for Empirical Legal Studies and a Senior Fellow at the Leonard Davis Institute of Health Economics. My academic work on law and economics, including research on stop-and-frisk policies, has been published in the *Stanford Law Review*, *University of Chicago Law Review*, *Journal of Empirical Legal Studies*, *American Economic Journal*, and *Journal of Legal Studies*, among others. My curriculum vitae, which includes a complete list of my publications, is included as **Appendix A**.

B. Materials Relied Upon

2. The opinions expressed in this report are based on my analysis of the information and materials available to me as of this date. I reserve the right to supplement my report in the event new information is produced in the case. A complete list of materials that I have relied upon for this particular assignment is included as **Appendix B**.[1]

3. I have directed my research assistant, Kathy Qian, and employees of Analysis Group, Inc., an economics research and consulting firm, to assist me in this assignment.[2] I am being compensated for my work on this assignment at the rate of $475 per hour. I also receive

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[1] I abide by the terms of the Confidentiality Agreement and supplemental Confidentiality Agreement governing the production of Milwaukee Police Department in-vehicle recordings and Record Management System data in this case. I reviewed and signed both agreements before reviewing any information produced in discovery in this matter designated "Confidential Information" that falls within the scope of either agreement.

[2] Ms. Qian and employees of Analysis Group, Inc. assisting me with this assignment have also reviewed and signed the general Confidentiality Agreement and the supplemental Confidentiality Agreement in force in this case, and have been instructed to abide by the terms of these agreements.

compensation based on the professional fees of Kathy Qian and Analysis Group. My compensation is not contingent on the results of my analysis or on the outcome of this litigation.

II. ALLEGATIONS AND ASSIGNMENT

A. Allegations

4. Plaintiffs' Amended Class Action Complaint for Declaratory and Injunctive Relief alleges that, since January 2008, the City of Milwaukee has conducted, and continues to conduct, an "unconstitutional, suspicionless stop-and-frisk program" through the Milwaukee Police Department ("MPD").[3]

5. Plaintiffs claim that the City of Milwaukee has a policy, practice, and custom of subjecting people "to police stops without individualized, objective, and articulable reasonable suspicion of criminal activity, and frisking [people] without individualized, objective, and articulable reasonable suspicion that the person is armed and dangerous," in violation of the Fourth Amendment to the U.S. Constitution.[4]

6. Plaintiffs also claim that the City of Milwaukee has a policy, practice, and custom of conducting MPD stops and frisks that "results in significant racial and ethnic disparities and that is motivated by race and ethnicity," in violation of the Fourteenth Amendment to the U.S. Constitution and Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d et seq. ("Title VI").[5] Plaintiffs further claim that the City of Milwaukee has a policy, practice, and custom of conducting stops and frisks that involves "racial and ethnic profiling" of Black and Latino people, in violation of the Fourteenth Amendment and Title VI.[6]

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[3] Amended Class Action Complaint for Declaratory and Injunctive Relief at ¶ 1, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. May 24, 2017), ECF No. 19.

[4] *Id.* at ¶ 300.

[5] *Id.* at ¶ 313.

[6] *Id.* at ¶¶ 313–14.

B. Assignment

7. I have been asked by counsel for the Plaintiffs to evaluate whether there is social science evidence that:

   i. since 2008, the MPD has conducted stops and frisks that disproportionately impact Black and/or Latino people;

   ii. any racial and ethnic disparities in the conduct of MPD stops and frisks can be fully accounted for by factors other than race and ethnicity;

   iii. there is a pattern of MPD stops conducted without the requisite reasonable suspicion; and

   iv. there is a pattern of MPD frisks that are conducted without the requisite reasonable suspicion.

8. I note that Plaintiffs requested from Defendants the production of data on every traffic stop, pedestrian stop, and frisk conducted by MPD officers from January 1, 2008 to the time of the request in April 2017.[7] The data sets produced by the Defendants do not include specific fields for reports of frisks, and only irregularly contain any frisk information; I therefore focus my analysis on the evaluation of traffic stops, pedestrian stops, and searches conducted in the course of traffic stops.

III. PARTIES TO THE LITIGATION

9. The Defendants in this matter include the City of Milwaukee ("Milwaukee"); the Milwaukee Fire and Police Commission ("FPC"), which oversees the Milwaukee Police Department ("MPD"); and Chief of Police for the MPD, Edward Flynn, acting in his official capacity.[8]

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[7] Plaintiffs' First Set of Requests for Production of Documents and Things to Defendants, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. April 6, 2017).

[8] Amended Class Action Complaint, *supra* note 3, at ¶¶ 27–29.

10. The named plaintiffs ("Plaintiffs")—Charles Collins; Tracy Adams, on behalf of her minor child D.A.; Caleb Roberts; Stephen Jansen; Gregory Chambers; Alicia Silvestre; David Crowley; Jeremy Brown; and Jerimiah Olivar—are individuals who allege that they were stopped, as pedestrians and/or drivers, without individualized, objective, and articulable reasonable suspicion of criminal activity.[9] In addition, Ms. Adams, on behalf of her minor child D.A.; Mr. Crowley; Ms. Silvestre; and Mr. Olivar allege that they were frisked and/or searched under circumstances that did not give rise to reasonable suspicion that they were armed and dangerous.[10]

11. Plaintiffs seek to certify:

    i. a Main Class consisting of "all persons who, since January 7, 2008, have been or will be stopped and/or stopped and frisked by MPD officers,"[11] and

    ii. a Subclass consisting of "all Black and Latino Members of the Main Class."[12]

IV. SUMMARY OF CONCLUSIONS

12. My analyses of the data produced by the Defendants in this matter lead me to reach the following conclusions.

    i. Black and Latino people are more likely than white people to be subject to traffic stops across Milwaukee, both in Milwaukee Police Department districts ("districts") in which the residential population is racially heterogeneous and districts in which the residential population is predominantly white. After controlling for non-racial and non-ethnic factors that might account for such disparities, the traffic stop rate for Black drivers in Milwaukee is higher than the traffic stop rate for white drivers by well over 500 percent. This difference in traffic stop rates between Black drivers and

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[9] *Id.* at ¶¶ 18–26.

[10] *Id.* at ¶ 8.

[11] *Id.* at ¶ 281.

[12] *Id.* at ¶ 289.

white drivers is statistically significant. After controlling for these same non-racial and non-ethnic factors, the traffic stop rate is higher for Latino drivers than white drivers by over 70 percent, but this difference is not statistically significant.

ii. Black and Latino people who are subjected to traffic stops are about 50 and 10 percent more likely, respectively, to be searched than white people who are subjected to traffic stops. The elevation in search rate is statistically significant for Black drivers but not Latino drivers.

iii. The rates of drug and weapon discovery during traffic stops are extremely low, occurring in well less than one percent of traffic stops in Milwaukee.

iv. Traffic stop searches of Black and Latino drivers are more than 20 percent less likely to lead to the discovery of drugs than traffic stop searches of white drivers, a statistically significant difference.

v. MPD officers are more likely to exercise leniency toward white motorists than toward Black and Latino motorists in issuing speeding tickets. In particular, Black and Latino drivers are, respectively, 12 and 16 percent less likely than white drivers to be cited at a speed just below a threshold that would result in a higher penalty. These differences are statistically significant.

vi. Across Milwaukee, Black people are 500 percent more likely than white people to be the targets of pedestrian stops, and this difference is statistically significant.

13. The aforementioned disparities in MPD treatment across racial and ethnic groups account for other relevant, non-racial and non-ethnic factors that might potentially give rise to such differences.

V. BACKGROUND

A. The Residents of Milwaukee

14. The City of Milwaukee is located in southeastern Wisconsin on the shore of Lake Michigan. As of 2015, Milwaukee covered 96 square miles and had a total population of almost 600,000

residents.[13,14] Median household income for Milwaukee was estimated at $35,958 in 2015, approximately $18,000 below the median household income in the United States. Approximately 29 percent of people in Milwaukee had incomes below the poverty level in 2016, as compared to approximately 16 percent in the United States overall for the same year.[15] The unemployment rate in Milwaukee as of January 2017 was 4.2 percent, lower than the 4.8 percent national average.[16]

15. Race and ethnicity data for the City of Milwaukee is obtained from the U.S. Census Bureau's American Community Survey ("ACS") from 2008 to 2015.[17] Given the limitations of information on racial and ethnic status in the Census data and in the data produced by Defendants, I use the following three groupings of Milwaukee residents for my analyses:[18]

    i. Individuals considered "Black" are those who self-report as "Black or African American." As explained in **Appendix C**, this group includes a very small percentage (0.9 percent) who self-report as both "Black" and "Hispanic or Latino."

    ii. Individuals considered "Latino" are those who self-report as "Hispanic or Latino" and do not also self-report as "Black."

    iii. Individuals considered "white" are those who self-report as "White" and "Not Hispanic or Latino."

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[13] *2015 Gazetteer Files – Wisconsin,* U.S. CENSUS BUREAU, https://www2.census.gov/geo/docs/maps-data/data/gazetteer/2015_Gazetteer/2015_gaz_place_55.txt (last visited Jan. 31, 2018).

[14] *2008-2015 American Community Survey 1-Year Estimates: Total Population – Milwaukee city, Wisconsin*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).

[15] *2011-2015 American Community Survey 5-Year Estimates: Selected Economic Characteristics,* U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).

[16] Federal Reserve Bank of St. Louis, *Unemployment Rate in Milwaukee-Waukesha-West Allis, WI (MSA)*, FRED ST. LOUIS, https://fred.stlouisfed.org/series/MILW355URN (last visited Dec. 2, 2017).

[17] *2011-2015 American Community Survey 5-Year Estimates: Hispanic or Latino Origin By Race (B03002)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).

[18] **Appendix C** provides details on the construction of the variables used in my analysis, including variables capturing race and ethnicity using U.S. Census data and data produced by the Defendants.

16. As presented in **Exhibit 1**, over the period 2008 to 2015, Black people have comprised 37 to 40 percent of the Milwaukee population, white people have comprised 36 to 42 percent, and Latino people have comprised 15 to 18 percent. People who are not Black, white, or Hispanic or Latino have made up 6 to 7 percent of the population over this time period. For the purpose of my analysis, I focus on the Black, Hispanic/Latino, and white racial and ethnic groups.

B. Traffic and Pedestrian Stops in Milwaukee

17. As of 2008, the Milwaukee Police Department had 2,016 officers and 694 civilian employees;[19] in 2015, those numbers had fallen to 1,886 and 632, respectively.[20]

18. **Exhibit 2** shows how the number of traffic and pedestrian stops changed over the period 2007–2015. Using data originally published in the 2015 MPD Annual Report,[21] I calculate an index measuring each year's stop count as a percentage of the stop count in 2007. Total traffic stops increased from 52,399 stops in 2007 to a peak of 196,904 stops in 2012, which is 376 percent of the 2007 level. After three years of rapid growth, the number of traffic stops began to level off to around 190,000 stops per year, before a decline to 149,604 stops in 2015. At the peak in 2012, there was roughly one traffic stop for every three Milwaukee residents annually; the most recent rate is approximately one traffic stop for every four residents.

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[19] U.S. Department of Justice - Federal Bureau of Investigation, *Table 78, Wisconsin: Full-time Law Enforcement Employees by State by City*, 2008 CRIME IN THE UNITED STATES (Sep. 2009), https://www2.fbi.gov/ucr/cius2008/data/documents/08tbl78wi.xls.

[20] U.S. Department of Justice - Federal Bureau of Investigation, *Table 78, Wisconsin: Full-time Law Enforcement Employees by State by City*, 2015 CRIME IN THE UNITED STATES, https://ucr.fbi.gov/crime-in-the-u.s/2015/crime-in-the-u.s.-2015/tables/table-78/table-78-state-pieces/table_78_full_time_law_enforcement_employees_wisconsin_by_cities_2015.xls/output.xls (last visited Jan. 31, 2018).

[21] MILWAUKEE POLICE DEP'T, ANNUAL REPORT 2015 12, http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/Archive-Annual-Reports/2015MPDAR58forWEB.pdf (last visited Feb. 14, 2018).

19. Relative growth in pedestrian stops since 2007 has been even greater. In 2012, there were almost 72,000 pedestrian stops, a five-fold increase in just five years. These numbers have also declined somewhat since 2012, but the 2015 figure is still more than triple the number of pedestrian stops in 2007.[22]

20. While there was explosive growth in both traffic and pedestrian stops between 2007 and 2015, the total annual counts of arrests and firearms recovered actually declined over this time period, by 38 and 6 percent, respectively. These findings are summarized by the orange line with circle markers and the black line with square markers in **Exhibit 2**. Given that traffic and pedestrian stops must be supported by reasonable suspicion of criminal activity and that frisks must be supported by reasonable suspicion that a stop subject is armed and dangerous, it is notable that arrests and recovery of firearms fell even as traffic and pedestrian stops dramatically increased.

C. The Milwaukee Police Districts

21. The City of Milwaukee is divided into seven police districts.[23] According to the MPD 2009 Annual Report, neighborhoods fall into police districts as follows:

    i. District 1 contains the University of Wisconsin-Milwaukee and the Lake Park, Lower and Upper East Side, and Historic Third Ward neighborhoods. District 1 is also noted for having the largest number of licensed establishments in Milwaukee.[24]

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[22] *Id.*

[23] The Milwaukee Police Department districts were re-mapped in 2009. The most substantial changes to districts involved the alteration of boundaries between Districts 2 and 6, as well as between Districts 1 and 5. *See* MILWAUKEE POLICE DEP'T, 2009 ANNUAL REPORT 5, http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/Documents/2009_Annual_Report.pdf (last visited Feb. 14, 2018).

[24] *Id.* at 12.

ii. District 2 contains the Walker's Point, Historic Mitchell Street, and Clarke Square neighborhoods.[25]

iii. District 3 contains the Avenues West, Miller Valley, and Menomonee Valley neighborhoods.[26]

iv. District 4 includes the Dretzka Park, Timmerman, and Woodlands neighborhoods and is home to several business parks and undeveloped land.[27]

v. District 5 is comprised of the Riverwest, Harambee, and Estabrook Park neighborhoods, and includes areas that were "historically challenged with violent crime."[28]

vi. District 6 includes the Jackson Park and Bay View neighborhoods, as well as the Mitchell International Airport.[29]

vii. District 7 includes Dineen Park, Sherman Park, and Enderis Park.[30]

22. For each district in Milwaukee, the share of the population that is composed of Black, Latino, and white residents is constructed based on the ACS.[31] The demographics of the MPD districts vary substantially, as can be observed in **Exhibit 3**. For the years 2011 through 2015, Black residents made up the largest single racial or ethnic group in Districts 3, 4, 5, and 7; while Latino residents made up the majority in District 2 and white residents made up the majority in Districts 1 and 6.

23. The current racial and ethnic composition of districts was influenced by the re-mapping of districts in 2009. **Exhibits 4A** and **4B** compare the distribution of the Black and Latino

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[25] *Id.* at 13.

[26] *Id.* at 14.

[27] *Id.* at 15.

[28] *Id.* at 16.

[29] *Id.* at 17.

[30] *Id.* at 18.

[31] Further information on the construction of these shares is provided in **Appendix C**.

populations across districts before and after redistricting in 2009. For ease of comparison, the old and new district boundaries are superimposed on maps of the 2015 Black and Latino population shares. **Exhibit 4A** presents the shares of Black residents in each Census tract and indicates that the eastern portion of District 5 formerly included a largely non-Black area that is now part of District 1. **Exhibit 4A** also shows that the 2009 remapping resulted in a shift of the eastern boundary of District 3 and the southern boundary of District 5 to incorporate a predominantly Black area that had previously been located in District 1. **Exhibit 4B** indicates the Latino population that was split between the former Districts 2 and 6 is now primarily located within the new District 2. These maps suggest that the 2009 remapping of MPD districts led to a higher share of Black residents in Districts 3 and 5 and a higher share of Latino residents in District 2 than was the case prior to 2009.

D. Data Limitations

24. All of the analysis in this report is subject to limitations in the data provided by Defendants. I note three significant shortcomings and their implications here; other data concerns are discussed elsewhere in this report.

25. The first limitation with the data provided by Defendants concerns frisks. Neither of the main data sources produced by Defendants, Tiburon Records Management System ("RMS") or Traffic and Criminal Software ("TraCS") (introduced and discussed in more detail in **Section VI**, **Section IX**, and **Appendix C**), provides sufficient data for analysis of frisks. In the RMS data, in some free text fields where officers describe encounters in their own words there are some mentions of "frisk," "pat down," and other related terms. It is not clear, however, whether officers consistently record such information each time a frisk occurs in the course of a traffic or pedestrian stop recorded in RMS.

26. Similarly, in the TraCS Version 7 ("T7 TraCS") data, which documents more than 800,000 stops, there are fewer than 100 encounters that include text fields in which officers mention

"frisk," "pat down," or other related terms in the course of describing the basis of a search.[32] The extraordinarily small number of encounters in which a frisk is noted suggests that officers do not record such information each time a frisk occurs in the course of a traffic or pedestrian stop recorded in TraCS.

27. In response to Plaintiffs' request for data on all MPD traffic and pedestrian stops conducted since January 1, 2008, including data documenting whether the stop involved a frisk and the basis for those frisks, Defendants stated that the MPD does not track the number of frisks its officers perform.[33] Additionally, Milwaukee Police Department Standard Operating Procedure 085 does not require officers to document frisks or the reasons for frisks, even though it addresses frisks and explicitly requires officers to document pedestrian stops.[34]

28. The lack of frisk data means that I am unable to analyze whether MPD officers are more likely to subject Black or Latino people to frisks than white people, or whether frisks of Black and Latino people are more likely to lack a legally sufficient justification as compared to frisks of white people.

29. A second limitation of the data provided by the Defendants is that the number of traffic stops reported in the MPD 2015 Annual Report is somewhat higher than the number reported in the data provided by Defendants. The disparity is roughly ten percent, so it should not impact the findings appreciably. But it is worth noting that the Plaintiffs may not have been provided all data documenting traffic stops.

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[32] In particular, in a search of the data produced by Defendants in files beginning "T7_TrafficStops," fewer than 100 encounters have text fields that include the terms "frisk," "pat " (with a trailing space to distinguish from misspellings of "plate"), "patting," "patted," "patdown," and/or "pat-down."

[33] *See* Letter from Joseph M. Russell, von Briesen & Roper, s.c. to Nusrat J. Choudhury & Jason D. Williamson, ACLU Foundation, Inc., Karyn Rotker & Laurence J. Dupuis, ACLU of Wisconsin Foundation and Shanya Dingle, Covington & Burling LLP 6 (July 5, 2017) [hereinafter Russell Letter, July 5, 2017] ("The outcome as to **whether a frisk occurred** is not separately tracked" (emphasis in original)).

[34] *See* MILWAUKEE POLICE DEP'T, STANDARD OPERATING PROCEDURE: 085 – CITIZEN CONTACTS, FIELD INTERVIEWS, SEARCH AND SEIZURE (Nov. 11, 2016) [hereinafter SOP 085], http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/SOP/085-CITIZENCONTACTSFIELDINTERVIEWSSEARCHANDSEIZURE2.pdf.

30. The third limitation of the data provided by the Defendants relates to pedestrian stops. The quality of the data on pedestrian stops provided by Defendants is extremely poor, and the results of the pedestrian stop analysis are subject to this important limitation. The main repository of pedestrian stop data is RMS. The numbers of pedestrian stops in two of the years of data that were provided by Defendants were highly inconsistent with other years; for example, some districts reported zero stops of white people in 2012. Furthermore, almost no information was provided on searches subsequent to pedestrian stops, which precluded performing this part of the analysis.[35] Additionally, according to the MPD's own documents, Latino individuals were not distinguished from white individuals in the pedestrian stop data recorded in RMS, which made a separate analysis of Latino pedestrian stops impossible.[36] The failure of the RMS pedestrian stop data to distinguish between Latino and white stop subjects may also render my finding of the difference in pedestrian stop rates between Black and white people an underestimate, because the category of white people includes Latino people—who may have been stopped at a higher rate than non-Latino white people.[37]

VI. TRAFFIC STOP ANALYSIS

31. In this section, I analyze data on traffic stops provided by the MPD with the aim of understanding whether MPD stop activity differs by the race or ethnicity of the individual subject to the stop. This requires several different analyses, detailed below. First, I examine whether traffic stops in Milwaukee are concentrated in predominantly Black and Latino neighborhoods. Next, I look at stop rates by the race of stop subjects, regardless of stop location. After these comparisons of overall rates, I use a regression analysis to control for non-racial and non-ethnic explanations for differences in stop rates. Next, I examine whether

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[35] Although the dataset underlying my pedestrian stop analysis contains a field "consent_person_search" indicating whether a consent search took place, in the vast majority of cases it is not filled in. See *infra* **Section IX** for further details.

[36] *See* MILWAUKEE POLICE DEP'T, FIELD INTERVIEWS, CONSENT SEARCHES, TRAFFIC STOP DATA COLLECTION & SSRS REPORTS (Dec. 18, 2015) (produced by Defendants) (MKE_0312367) ("Field Interview Cards in Tiburon do not capture Hispanic ethnicity. Therefore, officers enter individuals as White.").

[37] For a further discussion of the limitations of the pedestrian stop data and its consequences, see *infra* **Section IX**.

the rate at which contraband is discovered varies by race and ethnicity. Finally, I look at how search rates vary by race and ethnicity.

32. The produced data provides evidence that Black and Latino people are disproportionately affected relative to white people along two dimensions. First, the MPD has higher traffic stop and in most cases higher search rates in neighborhoods primarily populated by Black and Latino residents. Second, Black and Latino drivers were more likely to be stopped in all police districts in Milwaukee and more likely to be searched if subject to a traffic stop in Milwaukee as a whole. Using regression analysis to control for factors other than race and ethnicity that could potentially influence the rates of traffic stops and searches ensuing from traffic stops in Milwaukee, I find that Black and Latino drivers are still stopped and searched at higher rates than white drivers, and that these differences are statistically significant for Black drivers. An examination of contraband discovery in the produced data provides evidence that white people are more likely to be found with contraband, in particular drugs, if searched in a traffic stop, and therefore that the higher traffic stop and search rates of Black and Latino drivers are unlikely to be explained solely by the desire to maximize the discovery of drugs.

A. The Data on Traffic Stops Produced by the Defendants

33. The Defendants produced data on traffic stops conducted during the period December 1, 2010 through April 14, 2017 from TraCS.[38] This software is used to document the issuance of non-traffic citations and Wisconsin Uniform Traffic Citations[39] and to record a significant

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[38] *See* Letter from Joseph M. Russell, von Briesen & Roper, s.c. to Shanya Dingle, Covington & Burling LLP (May 15, 2017) [hereinafter Russell Letter, May 15, 2017] (accompanying produced data received on May 15, 2017). **Appendix C** contains detailed information on the produced data and the construction of variables from the produced data for the purposes of my analyses.

[39] Russell Letter, July 5, 2017, *supra* note 33, at 3–4.

number of the traffic stops,[40] some pedestrian stops (also known as "field interviews"),[41] and citizen contacts conducted by MPD officers.

34. The TraCS traffic stop data includes information on the date, time, and location of each traffic stop. The data indicates whether a stop resulted in a traffic citation, non-traffic citation, or warning.[42] The data also contains demographic information for each individual subject to a traffic stop, including gender, date of birth, and race.[43]

35. As discussed in further detail in **Appendix C**, the MPD has used two versions of the TraCS software. The MPD used the T7 version from January 2008 through 2017. In 2013, the MPD began to transition from the T7 version of TraCS to the T10 version. Between one-third and one-half of the traffic stops documented in the T10 TraCS data from 2015 through 2017 are missing demographic information about the subject of the stops. By contrast, none of the traffic stops documented in the T7 TraCS data over this time period are missing demographic information. Where demographic information is available in the T10 TraCS data, inconsistencies with the T7 TraCS data raise questions about the reliability and representativeness of the T10 TraCS data that does include demographic information. As described in further detail in **Appendix C**, in 2015 and 2016—the two years in which both versions of the TraCS software were in use by the MPD—the T10 TraCS data with complete demographic information contains disproportionately fewer traffic stops for Black drivers than the T7 TraCS data. This suggests that the absence of demographic information in the T10 TraCS data may not be random with respect to race: in other words, the one-half to one-

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[40] The reason field in TraCS may take on the values "Traffic Stop," "Dispatched Assignment," "Field Interview," "Other Reason," "Crash Investigation," "Criminal Offense," "Citizen Assist," and/or "Missing." For the traffic stop analysis, I limit the data to observations where the "Reason" field includes "Traffic Stop" as a value.

[41] SOP 085, *supra* note 34, at 2.

[42] *See* Russell Letter, July 5, 2017, *supra* note 33, at 3–4. See also a notification to "All Department Members" of the MPD to "Continue Using TraCS for Data Collection" despite the State legislature's repeal of a requirement to do so: "All traffic stops are required to have a traffic stop data form completed as per the directive." Memorandum from Regina Howard, Captain, Office of Mgmt., Analysis and Planning (OMAP) to All Dep't Members (Nov. 25, 2013) (produced by Defendants) (MKE_0006835).

[43] T7 TraCS data and T10 TraCS data.

third of T10 TraCS traffic stop data with missing demographic information in these years are likely to contain disproportionately more stops of Black drivers. Given this concern about the reliability and representativeness of the produced T10 TraCS data with demographic information, my analysis of traffic stops is limited to the T7 TraCS data for those years in which the majority of traffic stops were recorded in this version of the TraCS software—2011 to 2015.

36. Using T7 TraCS data, I calculate the traffic stop rate for different racial and ethnic groups in Milwaukee. For a meaningful measure of this rate, it is necessary to consider the quantity of stops in the context of driving intensity—the number of individuals of different groups on the road. An example will illustrate the importance of measuring traffic stop rates rather than the aggregate number of traffic stops. If we find that 750 out of 1,000 stops are of male drivers, it would appear that men are stopped more than their population share. But if three of four drivers are men then the traffic stop *rate* is equal by gender—because more men are on the road. For this reason, I use the number of licensed drivers as a proxy for driving intensity.[44,45]

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[44] *See* Letter from Daniel A. Graff, Assistant General Counsel, Wis. Dep't of Transp. to Larry Dupuis, Legal Director, ACLU of Wis. (July 28, 2017) (electronic media titled "Driver.txt"). In May 2017, the ACLU of Wisconsin submitted a request for public records of the Wisconsin Department of Transportation concerning demographic information relating to driver's license holders in Wisconsin. *See* Letter from Larry Dupuis, Legal Director, ACLU of Wis. to Kristina Boardman, Wis. Dep't of Transp. (May 19, 2017). The Wisconsin Department of Transportation provided only 2015 data on driver's license holders. The data includes information on the zip code, race and ethnicity of each driver with a valid driver license in the State of Wisconsin in 2015. Zip codes were allocated to 2015 Census tracts using the U.S. Department of Housing and Urban Development ("HUD") crosswalk to determine the total number of drivers in each Milwaukee Census tract in 2015. *See HUD USPS Zip Code Crosswalk Files*, U.S. DEP'T OF HOUSING AND URB. DEV., https://www.huduser.gov/portal/datasets/usps_crosswalk.html#data (last visited Jan. 31, 2018). The number of drivers was subsequently aggregated to the district level. Due to the fact that driver's license information was not produced for years other than 2015, I use the 2015 data as a proxy for the number of drivers, by race, ethnicity, and district, in the years 2010 through 2014. The distribution of licensed drivers is likely very stable so the use of 2015 data as a proxy for the racial and ethnic composition of drivers from 2010 through 2014 is unlikely to impact the results significantly.

[45] The number of licensed drivers has been used as a proxy in other studies examining the relationship between race and the probability of being subjected to a traffic stop. One study of racial profiling in North Carolina, for example, compares three proxies—the number of licensed drivers, an estimate of "drivers driving" that accounts for the fact that drivers may leave their home counties, and traffic accidents—and finds that "the three measures are indistinguishable in terms of predictiveness. That is, the proportion of citations issued to African Americans at the district level can be equally predicted by using residency data [on licensed drivers], "drivers driving"

This way, districts and driver categories (such as race and ethnicity) with different driving intensity can be compared on equal footing.[46]

37. The traffic stop rate is defined as the total number of traffic stops per 100 licensed drivers. To examine how the traffic stop rate varies across different dimensions, I construct versions of the traffic stop rate that vary by district, by race and ethnicity, and by year, as well as versions that vary by combinations of these dimensions, e.g., by both district and race.

B. Traffic Stops in Milwaukee are Concentrated in Predominately Black and Latino Districts

38. In order to see whether there is variation in traffic stop rates by race, I first conduct a simple comparison of traffic stop rates by district. The results are presented in **Exhibit 5**. The first row presents the overall traffic stop rate per licensed driver of any race in a district. I find that the majority-white District 6 has the lowest traffic stop rate over the period 2011 to 2015, with only 19 stops per 100 drivers. In contrast, the heavily-Black Districts 3 and 5 and the heavily-Latino District 2 have traffic stop rates ranging from 64 to 71 stops per 100 drivers—over triple the rate of District 6. Districts 4 and 7, which are majority Black, also have high stop rates in comparison to District 6, higher by 42 percent and 116 percent, respectively. By themselves, these findings suggest that the racial and ethnic makeup of a district may play a role in who gets stopped. But this finding is not dispositive because these districts could vary in other ways beyond racial and ethnic makeup that could influence

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data, or accident data." WILLIAM R. SMITH, ET AL., THE NORTH CAROLINA HIGHWAY TRAFFIC STUDY 82 (Jul. 21, 2003), https://www.ncjrs.gov/pdffiles1/nij/grants/204021.pdf.

[46] To the extent that the number of licensed drivers is an imperfect proxy for who is on the roads driving, it may tend to produce conservative estimates of racial and ethnic disparities in traffic stop rates: that is, it may understate the number of traffic stops experienced by Black and Latino drivers per time spent on the roads. According to the American Driving Survey: 2014-2015, on average white drivers spend more time driving and drive longer distances than Black or Hispanic drivers. *See* TIM TRIPLETT, ET AL., AMERICAN DRIVING SURVEY: 2014-2015 11–13 (Sept. 2016), http://publicaffairsresources.aaa.biz/wp-content/uploads/2016/09/AmericanDrivingSurvey2015.pdf.

district-level traffic stop rates. Below I attempt to control for numerous non-racial explanations for variation in traffic stop rates.

C. Black and Latino Drivers Are More Likely than White Drivers to be Stopped Across Milwaukee and in Each Milwaukee Police District

39. The evidence presented above indicates that districts with predominantly Black or Latino populations have higher traffic stop rates. The evidence also indicates that this pattern of differential traffic stop rates holds across all police districts in Milwaukee. **Exhibit 6** compares the traffic stop rates for Black, Latino, and white drivers in each district.[47] In every district, Black and Latino drivers were subject to a substantially higher rate of traffic stops than white drivers from 2011 to 2015. In particular, in the majority-white Districts 1 and 6, Black and Latino drivers experienced traffic stop rates that were over six and over three times the white stop rate, respectively. In the remaining districts, Black drivers experienced a stop rate of four to seven times the white stop rate, and Latino drivers experienced a stop rate of approximately two to three times the white stop rate.[48]

40. As shown in **Exhibit 7**, on average from 2011 to 2015, the MPD made:

    i. 77 traffic stops per 100 Black drivers;

    ii. 53 traffic stops per 100 Latino drivers; and

    iii. 15 traffic stops per 100 white drivers.

    In other words, across Milwaukee from 2011 to 2015, MPD officers stopped Latino drivers at over three and a half times the rate, and Black drivers at over five times the rate, at which they stopped white drivers.

41. **Exhibit 7** also shows that the racial and ethnic disparities in traffic stop rates grew from 2011 to 2015. In 2011, Black drivers were stopped at a rate 4.2 times the rate of white drivers, and Latino drivers were stopped at a rate 2.8 times the rate of white drivers. By 2015, these

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[47] The same information is also presented in table form in **Exhibit 5**.

[48] *See* **Exhibit 5**.

disparities had increased substantially. In that year, the Black traffic stop rate was 6.2 times the white traffic stop rate, while the Latino traffic stop rate had grown to 3.4 times the white traffic stop rate.

42. The growth in racial and ethnic stop rate disparities over the most recent five years for which there is reliable data suggests that this is a phenomenon that not only continues, but is increasing. Below I explore potential non-racial explanations for these large disparities.

D. Traffic Stop Regression Analyses

43. Much of the evidence presented above has been a comparison of how the traffic stop rate—i.e., the number of traffic stops per hundred drivers—varies over time, by location, and by race and ethnicity. This approach is informative and demonstrates the existence of significant racial and ethnic disparities in traffic stop rates, but cannot rule out the possibility that results are driven by factors other than race or ethnicity. Here and elsewhere in the report, I present results of regression analyses in order to address this possibility and refine the inquiry. Regression analysis is widely used throughout the social sciences and sciences in order to isolate the effect of a single characteristic on an outcome of interest and to rule out alternative explanations. While regression analysis is a powerful technique, as with any statistical approach, it is ultimately limited to the data available for inclusion in the analysis.

44. As discussed above, the evidence from the MPD traffic stop data indicates that Black and Latino drivers experience substantially higher rates of traffic stops than white drivers. To examine whether these disparities could potentially be explained by non-racial and non-ethnic factors, I use a regression analysis that estimates the relationship between the traffic stop rate and race/ethnicity while accounting for other potentially relevant factors.

45. The outcome of interest in this analysis is the traffic stop rate per 100 drivers of a given race or ethnicity (r) in a given district (d) and year (t):

$$Traffic\ Stop\ Rate_{rdt} = \frac{Total\ Traffic\ Stops_{rdt}}{Total\ Drivers_{rdt}} * 100$$

46. For example, there were 1,553 Black drivers in District 1 in 2011. In the T7 TraCS data, there were 1,339 traffic stops involving Black drivers in this district in 2011. As a result, the

traffic stop rate for Black drivers in District 1 in 2011 is (1,399/1,553) * 100 or 90 traffic stops per 100 Black drivers in the district per year in T7 TraCS.

47. I consider four different regression specifications to estimate the influence of Black drivers' race and Latino drivers' ethnicity, relative to white drivers' race and ethnicity, on their traffic stop rates.[49]

    i. The first specification estimates the average difference in traffic stop rates for Black and Latino drivers relative to white drivers, without any further controls.

    ii. The second specification introduces independent variables describing the racial makeup of the district. In particular, this specification includes variables measuring the shares of the district population comprised of Black and Latino people.

    iii. The third specification adds controls to address the possibility that stop rates are related to crime rates in a district. I do so by adding an explanatory variable for the total crime rate in the prior year (i.e., the lagged crime rate) in each district.[50] I also introduce a control for the male share of the population, by race. This controls for the possibility that a higher proportion of males may be associated with a higher crime rate.

    iv. The final specification allows for further variation in stop rates across districts and time by introducing an indicator variable for each year and district. Each indicator variable takes the value one in the corresponding year or district and zero otherwise. (The indicator variable for the year 2014, for example, equals one if the year is 2014 and zero otherwise; the indicator variable for District 3 takes the value one in District

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[49] Summary statistics of the variables included in these regressions are provided in **Appendix D**, **Exhibit D-1**.

[50] For information on total crime rates by Census tract, see Milwaukee Police Department, Wisconsin Incident Based Report (WIBR) Group A Offenses, http://itmdapps.milwaukee.gov/publicApplication_QD/queryDownload/login.faces (last visited Jan. 31, 2018). The total crime rate is calculated from the sum of the following crimes: Assault Offenses, Arson, Burglary, Criminal Damage, Locked Vehicle, Robbery, Sex Offense, Theft, Vehicle Theft, and Homicide. District-level crime rates are calculated from the Census-tract-level rates.

3 and zero everywhere else.) These indicator variables, also known as "fixed effects," control for overall differences across districts and over time.[51,52]

48. The estimated difference in stop rates between Black and white drivers is presented in **Exhibit 8A** for each of the above specifications. The purple squares represent each point estimate, and the black "whiskers" represent the 95 percent confidence interval (a measure of precision) for the estimate. The results indicate that on average over the period 2011 to 2015, even in specification 4 (which includes independent variables for the crime rate, demographic composition, and overall differences in location and time), the MPD stop rate was higher for Black drivers than white drivers by 103 stops per hundred drivers. This difference from zero is statistically significant at the 95 percent confidence level. In other words, if there were in fact no difference between the white and Black stop rates, the probability is less than 5 percent that the data would show a difference at least this large by mere chance.

49. It is important to emphasize that the magnitude of the difference in stop rates between Black and white drivers is extremely large, given that the stop rate for white drivers is around 18 stops per 100 drivers.[53] This means that Black drivers are stopped at well over six times the rate of white drivers—i.e., the Black traffic stop rate is more than 500 percent higher than the

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[51] Note that as the Black and Latino population shares vary only by district, their effects cannot be estimated simultaneously with district fixed effects. I therefore omit the Black and Latino population shares from specification 4.

[52] I am not able to account for differences in police deployment, because this data was not made available. Even if available, since deployment is a choice of the MPD, it, too may be influenced by factors other than reducing crime, and thus may not be a good control variable.

[53] As shown in **Exhibit D-2**, the first specification of the traffic stop regression yields a constant of 17.79. The interpretation of the constant in a regression is simply the average of the outcome (traffic stop rate) when all of the regressors are zero. In this case that means that both the "Black" and "Latino" variables would be zero, which means the driver is white. Thus the traffic stop rate for white drivers is 17.79 (rounded to 18) stops per 100 drivers. This figure differs from that shown in **Exhibit 5** due to differences in the way the averages are weighted.

white traffic stop rate.[54] This difference reflects the inclusion of control variables for the crime rate, demographic composition, and overall differences in location and time.

50. The statistical significance of the difference between the Black and white stop rates can be directly observed in **Exhibit 8A** by comparing the "whiskers" for the estimated difference in stop rates to the horizontal line at zero and noting that the 95 percent confidence interval does not include zero. In fact, each of the four specifications laid out above yields similar results: point estimates of the difference between the Black and white stop rates range from 99 to 103 stops per hundred drivers, and each of these estimates is statistically significant at the 95 percent confidence level.

51. Analogous results for Latino drivers are presented in **Exhibit 8B**. With the inclusion of independent variables for crime rate and demographic composition, as well as overall differences in location and time, the stop rate for Latino drivers is higher than the stop rate for white drivers by 14 stops per 100 drivers, but this difference is not statistically significant.[55]

52. Full regression results are provided in **Appendix D**, **Exhibit D-2**.

E. Contraband Discovery During Traffic Stops

i. Contraband is Discovered at Low Rates Overall, and at Even Lower Rates for Black and Latino Drivers

53. In this section, I evaluate the rates of contraband discovery during searches conducted in the course of traffic stops by MPD officers. The T7 TraCS traffic stop data includes information

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[54] In particular, the implied stop rate for Black drivers equals the white stop rate of 18 stops per 100 drivers (**Exhibit D-2**) + 103 stops per 100 drivers = 121 stops per hundred drivers, or $\frac{121}{18} = 6.72$ times the stop rate for white drivers.

[55] In magnitude, this elevation of 14 stops per 100 drivers translates to a Latino traffic stop rate that is about 78 percent higher than the white traffic stop rate. That is, the implied stop rate for Latino drivers equals the white stop rate of 18 stops per 100 drivers (**Exhibit D-2**) + 14 stops per 100 drivers = 32 stops per 100 drivers, or $\frac{32}{18} = 1.78$ times the stop rate for white drivers.

on whether the stop involved the search of a driver or vehicle and whether the search resulted in the discovery of contraband, which is classified in the data into the following categories: "illicit drug(s)/paraphernalia," "intoxicant(s)," "weapon(s)," "evidence of a crime," "stolen goods," "excessive cash," or "other."[56] As summarized in **Exhibit 9A**, 14,484 traffic stop searches are documented in the T7 TraCS traffic stop data between 2011 and 2015. Of those searches, 3,935 (27 percent) resulted in the discovery of contraband.

54. In addition to considering total contraband discoveries, I also focus on two subsets of contraband: drugs and weapons. Drugs constitute the majority of contraband discoveries,[57] and weapons may be of particular interest from a policy perspective. **Exhibits 9B** and **9C** indicate that from 2011 to 2015 the discovery of a weapon during a traffic stop was an extremely rare event. Only 2.5 percent of the 580,816 traffic stops recorded in T7 TraCS led to a search (**Exhibit 9B**) and of those searches only 3.2 percent resulted in the discovery of a weapon (**Exhibit 9C**). This translates to an overall rate of 0.08 percent of all traffic stops conducted from 2011 to 2015 and recorded in T7 TraCS resulting in the discovery of a weapon. The discovery of drugs was more common, but still rare, with 17.5 percent of traffic searches yielding drugs (**Exhibit 9C**). Given that only 2.5 percent of traffic stops led to a search, this corresponds to an overall rate of 0.44 percent of traffic stops recorded in T7 TraCS resulting in the discovery of drugs in this time period.

55. As shown in **Exhibit 9C**, across districts over the period 2011 to 2015, the rate of drug discovery per search conducted during a traffic stop ranged from 10.4 to 26.9 percent, with the lowest rate in majority-Latino District 2 and the highest rate in majority-white District 6. The rate of weapon discovery per search, meanwhile, ranged from 1.6 percent in District 6 to 4.1 percent in District 3.

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[56] Defendants produced a Code Table providing these classifications. *See* Codes - TSContraband.csv (produced by Defendants) (MKE_0066948).

[57] *See* **Appendix C**, **Table C-1**.

56. As **Exhibit 9A** also indicates, the rates of total contraband discovery per search were 0.9 and 2.6 percentage points *lower* for Black and Latino drivers, respectively, than for white drivers. This finding suggests, preliminarily, that Black and Latino drivers may have been "over-searched" in comparison to white drivers. Below I investigate this hypothesis using regression analysis.

ii. Statistical Analysis of Contraband Discovery

57. In this section, I conduct multivariate regression analyses to determine whether the discovery of contraband in a search conducted during traffic stops differs by race and ethnicity after controlling for other demographic factors, as well as the time and district in which the traffic stop search occurred. In my first set of analyses, I examine the probability that contraband is discovered if an individual is subjected to a search. The dependent variable is an indicator variable equal to 100 if contraband is discovered and zero otherwise. I estimate four regression specifications.[58]

    i. The first specification controls only for the driver's race and ethnicity—i.e., whether he or she is Black or Latino.

    ii. The second specification adds controls for the driver's age and gender.

    iii. The third specification adds controls for the time of day the stop occurred. These controls take the form of fixed effects for the quarter of the day (9:00 am to 2:29 pm, 3:00 pm to 8:59 pm (the evening commute), 9:00 pm to 2:59 am (nighttime), 3:00 am to 8:59 am).

    iv. The fourth specification augments the set of controls with fixed effects for year and district.

58. The full set of regression results is provided in **Exhibit 10**. After controlling for other driver characteristics, time of day, year, and district (specification 4), the probability of discovering contraband is lower for Black drivers than for white drivers by two percentage points,

[58] Summary statistics of the variables included in these regressions are provided in **Appendix D**, **Exhibit D-3**.

although this difference is not statistically significant. Similarly, after controlling for the variables in specification 4, there is no statistically significant difference between the probability of contraband discovery for Latino drivers and the probability of contraband discovery for white drivers.

59. I also analyzed two specific types of contraband—drugs and weapons—using the multivariate regression specifications laid out above. The results for drug discoveries are provided in **Exhibit 11**. These results reveal that the probability that an MPD officer finds drugs, conditional on searching in the context of a traffic stop, is almost five percentage points lower for both Black and Latino drivers than for white drivers, and both differences are statistically significant at the 99 percent confidence level (specification 4). For context, consider that on average, 21 percent of traffic stop searches of white people result in the discovery of drugs (**Exhibit 11**, specification 1). A five percentage point difference, therefore, translates to a drug discovery rate that is more than 20 percent lower for Black and Latino drivers in comparison to white drivers.

60. Results of the regression analysis of the probability of weapon discovery in the context of a traffic stop search are provided in **Exhibit 12**. After controlling for driver characteristics, time of day, year, and district (specification 4), there is no statistically significant difference across racial and ethnic groups in the probability that an MPD officer finds a weapon when conducting a search in the course of a traffic stop.[59]

[59] The regression results for the probability of contraband, drug, and weapon discovery are robust to the inclusion of controls for the officer's description of the stop ("Speed Violation," "Vehicle Registration," "Seat Belt," "Impaired Driving," "Vehicle Equipment Violation," "Stolen Auto," "Burglary Investigation," and "Other Rules of the Road") and the district crime rate. When these controls are added to those in specification 4 of the contraband discovery regression, there is, as before, no statistically significant difference between the Black and white or Latino and white contraband discovery rates. Similarly, when these controls are introduced to specification 4 of the drug discovery rate regression, Black and Latino drivers subject to a traffic stop search are less likely than white drivers to be discovered with drugs by between 4.5 and 5 percentage points, and both these differences are statistically significant. Finally, when these controls are added to specification 4 of the weapon discovery rate regression, there is, as before, no statistically significant difference between the Black and white or Latino and white weapon discovery rates. The full results of these regressions are available upon request.

61. Altogether, after controlling for driver characteristics, time of day, year, and district, I conclude: (1) Black and Latino drivers in the city of Milwaukee are less likely than white drivers to be found with drugs when searched in the course of a traffic stop, and (2) there is no statistically significant difference in weapon or overall contraband discovery rates across racial and ethnic groups.

F. Black and Latino Drivers are Searched at Higher Rates than White Drivers

62. Although white drivers are more likely to be found with contraband, particularly drugs, in the course of a traffic stop search, MPD officers are more likely to search Black and Latino drivers who are subjected to stops. The percentage of traffic stops that involve searches over the period 2011 through 2015 is under three percent, on average, as presented in **Exhibit 13**. However, the vast majority of these searches—87 percent—involve Black or Latino drivers.[60] The search rate for Black drivers (2.81 percent) is almost twice as high as the search rate for white drivers (1.45 percent); the search rate for Latino drivers (2.63 percent) is over 80 percent higher than that for white drivers.

63. To examine whether the MPD's search decisions are systemically different by race, I use a multivariate regression analysis that controls for factors other than race that might influence the probability of a search. The dependent variable in this regression is an indicator variable that equals 100 if an individual stopped by the MPD is then searched (i.e., a realized search probability of 100 percent) and zero if he or she is not searched. I estimate four different regression specifications.[61]

   i. The first specification includes controls only for the driver's race and ethnicity.

   ii. The second specification introduces controls for the driver's age and gender.

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[60] These statistics include searches of vehicles and searches of drivers, both of which often occur during the same traffic stop. See the "driversearchconducted" and "vehiclesearchconducted" fields in T7 TraCS traffic stop data.

[61] Summary statistics of the variables in these regressions are provided in **Appendix D**, **Exhibit D-4.**

iii. The third specification introduces a set of controls relating to the officer's description of the stop: "Speed Violation," "Vehicle Registration," "Seat Belt," "Impaired Driving," "Vehicle Equipment Violation," "Stolen Auto," "Burglary Investigation," and "Other Rules of the Road."[62] Including these variables allows for the possibility that MPD officers may be inclined to conduct searches based on the circumstances of the traffic stop, and that these circumstances may potentially be correlated with the driver's race. This specification also introduces time-of-day controls, i.e. fixed effects for each of four six-hour windows of time in the day during which the stop may have occurred.

iv. The fourth specification introduces fixed effects for each year and district, which capture overall differences in stop rates across districts and time.

64. Estimation results for each specification are presented in **Exhibit 14**. Without controlling for any potentially confounding factors (specification 1), the search rate for Black drivers subject to a stop is 1.4 percentage points higher than the search rate for white drivers, and the search rate for Latino drivers is 1.2 percentage points higher than the search rate for white drivers. After controls are introduced for driver characteristics, the officer's description of the traffic stop, and district and year fixed effects (specification 4), these differences fall to 0.73 and 0.17 percentage points, respectively.[63] For Black drivers, the difference in search rate remains statistically significant at the 95 percent confidence level. To put the magnitude of this result into context, consider that on average, 1.44 percent of traffic stops of white drivers involve a search (**Exhibit 14**, specification 1), which means that stops of Black drivers lead

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[62] Other reasons for a traffic stop that MPD officers could select in the "Reason Detail" field of the data include "Crash Investigation," "None," "Shooting Investigation," and "Special Patrol." These options are excluded from the regression. Therefore, the coefficient on the indicator variable for "Vehicle Equipment Violation" is interpreted as the effect of "Vehicle Equipment Violation" on the traffic stop rate, relative to the omitted reasons.

[63] These results are robust to the use of the district crime rate as a control. When the control variables in specification 4 of the traffic stop search rate regression are augmented with the district crime rate, the search rate for Black drivers subject to a traffic stop is 0.72 percentage points higher than the search rate for white drivers, and the search rate for Latino drivers is 0.16 percentage points higher than the search rate for white drivers. The difference is statistically significant for Black but not Latino drivers. The full results of this regression are available upon request.

to 50 percent more searches than stops of white drivers, even after controlling for all of the factors described above. This finding is especially significant because, as explained above in **Section E**, Black and Latino drivers are less likely than white drivers to be found with drugs when searched during a traffic stop.

65. To further examine how the driver's race and ethnicity influence the probability that the MPD will conduct a search after a traffic stop, I also estimate a set of regressions in which driver race and ethnicity are allowed to have different effects in each district. That is, I include an indicator variable for each *combination* of driver race/ethnicity and district. I consider a district-specific version of each of the four specifications described above.[64]

66. To estimate how race and ethnicity affect search rates, I then subtract the "white" effect from the "Black" and "Latino" effects in each district. **Exhibit 15A** plots the difference in the Black and white search rates in each district after controlling for driver characteristics, the officer's description of the stop, time of day, and year (specification 4). In every district except District 4 and District 7, the MPD is more likely to search a Black driver subject to a traffic stop than a white driver; this difference is statistically significant at the 95 percent confidence level. **Exhibit 15B** plots the same differences for Latino drivers, who are more likely to be searched in Districts 1, 2, 5, and 6 (although the difference is only statistically significant at the 95 percent level in Districts 1 and 5).

67. In interpreting these analyses of traffic stop search rates, it is important to keep in mind that they are search rates given that a traffic stop has occurred. Both the number of traffic stop searches and the number of traffic stops, therefore, influence this rate. This means that a high search rate of a particular group could result from a low stop rate, with a high percentage of suspicious persons stopped, which would be desirable. So too could it result from an intensive but scattershot approach to both stops and searches, which would be undesirable. Thus one must take care in interpreting search results without context.

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[64] The fourth specification introduces only year fixed effects, as the district-specific race effects render district fixed effects redundant. Full regression results are reported in **Appendix D, Exhibit D-5**.

VII. MILWAUKEE POLICE ISSUE SPEEDING CITATIONS WITH HIGHER PENALTIES TO BLACK AND LATINO DRIVERS

68. Thus far I have taken several different approaches to determining whether Black and Latino people are treated differently than white people by the MPD. Using regression analysis allows one to control for many factors for which there is data, in order to isolate the effect of race and ethnicity on stop rates and stop outcomes. The evidence discussed above shows that Black drivers are: (1) stopped at higher rates than white drivers, then (2) searched at higher rates after the initiation of a traffic stop, while (3) yielding less contraband, particularly drugs.

69. To further examine whether there is evidence that MPD treatment of stopped individuals is motivated by race and/or ethnicity, I now use data on speeding tickets to shed light on another aspect of police-citizen encounters: officers' exercise of leniency in their treatment of stop subjects. The potential for leniency to affect outcomes is, of course, present in any encounter, but generally hard to measure with available data. Speeding data offers a unique opportunity to measure the effect of leniency—and differences in the exercise of leniency across race/ethnicity—because the penalties associated with speeding increase in discrete steps at well-known "break-point" speeds above the limit. When an officer chooses to be lenient, the officer may record the speed in excess of the limit as just below the break-point. As a result, the distribution of excess speeds for which tickets are issued may spike at the speeds just below the break-point. Differences in the spikes across races and ethnicities provide a measure of the variation in officer treatment along racial and ethnic dimensions.[65,66]

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[65] *See, e.g.*, Nejat Anbarci & Jungmin Lee, *Detecting Racial Bias in Speed Discounting: Evidence from Speeding Tickets in Boston*, 38 INT'L REV. OF L. & ECON. 11 (2014); *see also* Felipe Goncalves & Steven Mello, *A Few Bad Apples? Racial Bias in Policing* (Jan. 9, 2018), http://www.princeton.edu/~fmg/JMP.

[66] Importantly, this analysis is completely independent of the overall driving tendency of people of different races and ethnicities. Even if people of one race or ethnicity were to drive faster than others, on average, there would be no reason to expect the share of speeds just below the break-point to differ by race or ethnicity.

70. Below, I examine how spikes in the distribution of tickets at excess speeds just below break-points vary across race and ethnicity in Milwaukee, and I find evidence that MPD officers treat white drivers with more leniency than Black or Latino drivers. I begin by providing an overview of the data on speeding citations produced by Defendants. I then examine the schedule of speeding penalties in Wisconsin to identify break-point excess speeds and show that the pattern of ticket spikes just below these speeds is consistent with the exercise of preferential leniency towards white drivers. Finally, I use a regression analysis to isolate the effect of racial and ethnic bias from potentially confounding factors, and find that race and ethnicity still have a statistically significant and substantial impact on officer leniency.

A. MPD Data on Speeding Citations

71. The MPD produced data on speeding citations as part of its Traffic and Criminal Software Electronic Citation datasets ("TraCS ELCI"). The TraCS ELCI data is available for both the T7 and T10 versions of TraCS and includes information on the location of the stop, the speed zone, and the excess speed at which a speeding ticket is issued. The TraCS ELCI data also contain information on the characteristics of individuals receiving citations, including race and ethnicity.[67] For the purpose of the following analysis, I consider speeding citations—that is, speeding tickets—recorded in TraCS ELCI for the period January 2010 through June 2017.[68] All of these tickets were issued for violations in zones with speed limits of 15 to 55 mph. Further details on the TraCS ELCI data are provided in **Appendix C**.

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[67] MPD officers complete ELCI forms in TraCS when they conduct traffic stops that involve the issuance of a Wisconsin Uniform Traffic Citation. Defendants explain that when officers complete a form to enter data about a traffic stop in TraCS, "the officer had the ability to also file an … 'ELCI' … form." Russell Letter, July 5, 2017, *supra* note 33, at 3.

[68] In particular, I select those observations for which the field for excess speed is populated. See **Appendix C** for further details on the ELCI data and the construction of the sample for analysis.

B. Schedule of Penalties for Speeding

72. In Wisconsin, traffic citations for speeding offenses are associated with two types of penalties, speeding fines (composed of "deposit" amounts and court costs) and demerit points. **Exhibit 16** depicts the relationship between excess speed and speeding penalties in fixed-speed-limit zones, for speeds between 5 and 25 mph over the speed limit.[69] The large-dashed orange line indicates the relationship between excess speed and the "deposit" component of the fine (the "deposit schedule"), and the small-dashed brown line indicates the relationship between excess speed and demerit points ("demerit points schedule").[70] As **Exhibit 16** shows, as excess speeds increase from 5 to 25 mph over the limit, there are three discrete increases in penalties—first at 11 mph, second at 16 mph, and third at 20 mph. An officer exercising discretion may choose to adjust the speed recorded on the citation to just below these break-points, thereby reducing the penalty associated with the ticket. I therefore refer to the speeds immediately below the penalty-increase break-points—10 mph, 15 mph, and 19 mph—as "lenient speeds."

C. Tickets Issued to Black and Latino Drivers Are Less Likely to Be for Lenient Speeds

73. I now examine the distribution of excess speeds recorded in speeding tickets in the TraCS ELCI data. **Exhibit 17A** plots the percentage of tickets issued at each speed between 5 and 25 mph over the limit (red line), as well as a smoothed estimate of this distribution (grey

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[69] Deposit amounts are set according to the Wisconsin Revised Uniform State Traffic Deposit Schedule and vary according to the speed in excess of the speed limit, as recorded by the police officer, and the speed zone. All speeding citations recorded in the TraCS ELCI data occur in zones with speed limits of 15 to 55 mph, and where fixed-speed-limit penalties therefore apply. Higher deposits apply to speeding violations on roads with 65 or 70 mph limits, but up to 39 mph above the limit, the jumps in the deposit schedule occur at the same excess speeds on all roads. *See* WIS. JUDICIAL CONFERENCE, STATE OF WISCONSIN, REVISED UNIFORM STATE TRAFFIC DEPOSIT SCHEDULE (2017), https://wicourts.gov/publications/fees/docs/bondsched17.pdf.

[70] Accumulation of twelve demerit points within a timeframe of twelve months results in a driving license suspension. *See* State of Wis. Dep't of Transp., *Wisconsin's Point System*, WISCONSIN.GOV, http://wisconsindot.gov/Pages/dmv/license-drvs/susp-or-rvkd/point-system.aspx (last visited Jan. 31, 2018).

line).[71,72] The smoothed estimate is an attempt to approximate what the true distribution of speeds would be, without any leniency. Spikes in the percent of tickets issued at the lenient speeds of 10 and 15 mph over the speed limit (indicated by dotted black lines) suggest that officers are, in some cases, exercising leniency by issuing tickets for speeds below actual measured speeds.[73] We can think of the vertical distance between the red line and grey lines—i.e., the difference between the percentage of tickets issued at a given excess speed and the percentage of tickets predicted by the smoothed estimate—as a measure of "excess tickets" at that speed. Spikes in excess tickets at lenient speeds, as illustrated in **Exhibit 17B**, further reveal the effects of officer leniency.

74. Before continuing, it is worth considering an alternative explanation for these spikes—driver, rather than officer, behavior. It could be that drivers are cognizant of the penalty schedule and adjust their speed accordingly, driving preferentially at lenient speeds so they may secure the benefits of speeding without incurring relatively greater penalties. This is highly unlikely for three reasons. First, it would be difficult for drivers to control their speed so precisely, particularly in non-highway conditions.[74] Second, speedometers are not precise to one-mph increments.[75] Third, studies in other locales have found that the spikiness of recorded speeds

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71 The smoothed distribution is a kernel density estimate of the excess speed distribution. Kernel density estimation is a standard statistical technique. *See, e.g.*, Nicholas J. Cox, *Speaking Stata: Density Probability Plots*, 5:2 STATA J. 259 (2005), http://www.stata-journal.com/sjpdf.html?articlenum=gr0012.

72 The majority of speeding offenses recorded in the TraCS ELCI data (92 percent) involve recorded excess speeds between 10 and 25 mph; a speed of 15 mph over the speed limit is the most commonly-recorded violation.

73 This is consistent with other analyses of speeding citations. Goncalves and Mello, for example, discovered similar bunching in data from the Florida Highway Patrol. Goncalves & Mello, *supra* note 66. Examining the speeds ticketed by the Florida Highway Patrol between 2005 and 2015, Goncalves and Mello found "excess mass" at speeds just below fine increases, with the opposite occurring at speeds just after fine increases. *Id.* They concluded that "officers systematically manipulate the charged speed, commonly charging speeds just below fine increases after observing a higher speed, perhaps to avoid an onerous punishment for the driver." *Id.*; *see also* H. J. Kleven, *Bunching*, 8 ANN. REV. OF ECON. 435 (2016).

74 Anbarci & Lee, *supra* note 66, at 14.

75 *See, e.g.*, Frank Markus, *Speedometer Scandal!*, CAR & DRIVER (April 2002), https://www.caranddriver.com/features/speedometer-scandal; *see also* Speedometer, 49 C.F.R. § 393.82 ("The speedometer must be accurate to within plus or minus 8 km/hr (5 mph) at a speed of 80 km/hr (50 mph).").

varies significantly by police officer, suggesting that it is a function of officer, rather than driver, behavior.[76]

75. To examine how officer exercise of leniency varies with the driver's race and ethnicity, I calculate "excess tickets"—how many more tickets are issued at each excess speed than would be expected if there were no officer leniency. **Exhibit 18A** plots the difference in "excess tickets" issued to white and Black drivers at each excess speed. If there were no difference in officer leniency by driver race, the line would be completely flat. In fact, one observes large spikes exactly at the lenient speeds. At 10 mph over the speed limit, for example, white drivers were issued excess tickets of 1.62 percentage points and Black drivers were issued excess tickets of 0.65 percentage points, for a difference of 0.97 percentage points. The positive spikes in this difference at the lenient speeds of 10, 15, and 19 mph suggest that white drivers are more likely to experience leniency in the form of tickets issued at lower speeds. These relatively small percentages understate a very large effect. We cannot know the true excess speeds at which the drivers were traveling, but from **Exhibit 17A** it seems likely that they were mostly driving 11 to 13 mph over the speed limit. Together with the 2.1 percent of tickets issued at the excess speed of 10 mph these make up about 5.5 percent of the total speeding tickets. This means that the 0.97 percentage point difference in excess tickets at the lenient speed of 10 mph over the speed limit actually translates to almost 20 percent more white drivers being granted a lower speed on their ticket, relative to Black drivers.

76. Similarly, **Exhibit 18B** plots the difference in "excess tickets" issued to white and Latino drivers. Again, positive spikes at the lenient speeds of 10, 15, and 19 mph suggest that white drivers are more likely to experience leniency in speeding tickets, although this data is noisier. Analogous to the calculations above, there were 1.62 percentage points of excess tickets for white drivers and 0.99 percentage points for Latino drivers at an excess speed of 10 mph, for a difference of 0.63 percentage points. Since 5.5 percent of all tickets were

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[76] Anbarci & Lee 2014, *supra* note 66, at 15.

issued at speeds from 10 to 13 mph over the limit, this means there were about 11 percent more tickets issued to white versus Latino drivers at the lenient speed.

D. Racial and Ethnic Disparities in Officer Exercise of Leniency in Speeding Tickets Persist After Accounting for Differences in Driver Characteristics, Speed Limit, Time of Stop, and MPD District

77. In this section, I conduct regression analyses to determine whether the differences in leniency experienced by Black and Latino drivers, as compared to white drivers, remain after accounting for other factors that may influence the recorded speed on speeding citations. In particular, I use a linear probability model to estimate the likelihood of being charged at a lenient speed if issued a speeding ticket. The dependent variable in each regression is an indicator equal to one if the speeding ticket is for a speed one mph below the threshold for a higher penalty and zero otherwise. In other words, I estimate the likelihood that a driver receiving a speeding ticket is recorded as driving at a lenient speed of 10 mph, 15 mph, or 19 mph above the speed limit.

78. I estimate five regression specifications, which include controls, sequentially, for:[77]

   i. whether the subject was Black or Latino;

   ii. the subject's gender (i.e., an indicator variable equal to one if the subject was male and zero otherwise), age, and age squared;

   iii. the subject's height and weight;

   iv. the speed limit that applied to the subject's speeding citation, as well as fixed effects for the year and quarter and an indicator equal to one if the stop occurred on a weekday; and

   v. district fixed effects, which control for various district-level factors, such as the crime rate, that might influence officers' exercise of leniency.

[77] Summary statistics of the variables included in these regressions are provided in **Appendix D**, **Exhibit D-6**.

79. The results of this analysis are summarized in **Exhibits 19A** and **19B**, with full estimation results presented in **Appendix D**, **Exhibit D-7**. The results indicate that after controlling for driver characteristics, speed limit, time of stop, and district, speeding tickets issued to Black and Latino drivers were, respectively, 3.4 and 4.5 percentage points less likely to record lenient excess speeds than tickets issued to white drivers. Both of these differences are statistically significant at the 95 percent confidence level. These results suggest that race and ethnicity influence the lower levels of leniency exercised by officers in their treatment of Black and Latino drivers issued speeding citations. Moreover, the effect of race and ethnicity on the likelihood of experiencing leniency if a driver is issued a speeding ticket is sizeable. To put these results into context, 28.7 percent of speeding tickets issued to white drivers from January 2010 through June 2017 were for lenient speeds (**Exhibit D-7**, specification 1). A decrease of 3.4 or 4.5 percentage points from the white lenient-speed rate of 28.7 percentage points is equivalent to a decrease of 12 or 16 percent, respectively. In other words, the lenient-speed rates for Black and Latino drivers are 12 and 16 percent lower, respectively, than the lenient-speed rate for white drivers.

VIII. REASONABLE SUSPICION ANALYSIS

80. In this section, I describe the patterns of traffic and pedestrian stops with individualized, objective, and articulable reasonable suspicion as determined by Ms. Margo Frasier.[78]

81. Ms. Frasier first reviewed all 823,186 records recorded in the T7 TraCS data, of which she determined that 716,144 were discretionary stops (i.e., traffic and pedestrian stops). The data reviewed include both coded and short free text fields related to the reason for stops. Ms. Frasier found that 51 percent of T7 TraCS stop records demonstrate individualized, objective, and articulable reasonable suspicion of criminal activity, while 49 percent of stop records failed to demonstrate legal justification. Separating these into traffic and pedestrian stops, Ms. Frasier found that for the 635,043 traffic stops, 48 percent failed to demonstrate that the

[78] Report of Margo Frasier, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. Feb. 20, 2018).

officer had individualized, objective, and articulable reasonable suspicion of a criminal offense or traffic or vehicle equipment violation, as required by the Fourth Amendment to the U.S. Constitution. For the 81,101 pedestrian stops, she found 59 percent failed to demonstrate that the officer had individualized, objective, and articulable reasonable suspicion.

82. Ms. Frasier also reviewed a sample of 800 police-civilian encounters from RMS for the years of 2016 and 2017 that I provided to her.[79] It should be noted that of the 111,108 police-civilian encounters documented in the 2010–2017 RMS data produced by Defendants, 56,975 encounters had no record containing any narrative description of the reason for the encounter. Based on this information, 51 percent of police-civilian encounters documented in RMS lack any information about the reason for the stop, making it impossible to determine whether the officer who conducted the stop had individualized, objective, and articulable reasonable suspicion of criminal activity before making the stop. Such a high rate of missing information about the circumstances giving rise to pedestrian and traffic stops documented in RMS raises serious concerns that a significant portion of those stops may have been conducted without the individualized, objective, and articulable reasonable suspicion of criminal activity or a traffic or vehicle equipment violation as required by law.

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[79] A sample of 800 police-civilian encounters was pulled from the union of several data sets produced by the Defendants: RMS Narratives (MKE_0609290), RMS FI Person (MKE_0096271), RMS FI Vehicle (MKE_0096272), RMS Persons (MKE_0013312), and RMS Vehicle datasets (C0000011). Of these 800 police-civilian encounters, 400 encounters per year were pulled for 2016 and 2017. For each year, 50 percent consisted of police encounters involving at least one Black subject, and 50 percent consisted of police encounters that did not involve any Black subjects. Frasier was provided all relevant long text fields ("narratives") corresponding to the 800 police-civilian encounters in the sample. These narratives were pulled from the RMS Narratives (MKE_0609290), Field Interview-Consent Search-Contraband (MKE_0601169 and MKE_0601170), TraCS Citizen Contact (MKE_0096273 and MKE_0096274), and TraCS Non-Traffic Citation (MKE_0066975, MKE_0066976, MKE_0013321, and MKE_0013322) datasets. The total number of narratives associated with the 800 randomly sampled police-civilian encounters was 1,122 because some encounters were associated with narratives from more than one data source. The 1,122 narratives included 327 from the RMS Narratives dataset, 748 from the Field Interview-Consent Search-Contraband, 37 from the TraCS Non-Traffic Citation dataset, and 10 from the TraCS Citizen Contact dataset. The designation of traffic versus pedestrian stops was determined by joining the RMS datasets to the Computer Aided Dispatch ("CAD") datasets using the CAD call number and using the "cad_call_type_final_d" column. RMS data without CAD call numbers originated from the RMS FI datasets and were assumed to be pedestrian stops.

83. From the sample of 800 RMS encounters, Ms. Frasier excluded stops involving multiple subjects and incidents that were not determined to be discretionary stops.[80] After these exclusions, the sample contained 485 discretionary stops. In addition to utilizing data from a different system, this second review differed from the first in that it primarily involved longer free text fields and paragraph-length narrative text describing the stops rather than coded or short free text fields setting forth the reason for the stops. Ms. Frasier found that in 41 percent of these stops the reporting officer's documentation failed to provide legal justification for the stop. In particular, 15 percent of the 97 traffic stops she analyzed failed to demonstrate individualized, objective, and articulable reasonable suspicion, as did 47 percent of the 388 pedestrian stops examined.

84. The rates of stops failing to demonstrate legal justification as determined by Ms. Frasier's analysis are higher than other jurisdictions with which I am familiar. For example, in New York City from 2004 to 2009, approximately 30 percent of stops lacked sufficient documentation to demonstrate legal justification.[81] More recently, 21 percent of stops in Philadelphia in the first half of 2017 failed to demonstrate legal justification.[82] Both of these cities have been subject to lawsuits claiming racially disparate treatment of citizens by their police force, and both have taken measures in the past several years to address these concerns. By comparison, the rate of stops failing to demonstrate legal justification identified by Ms. Frasier in Milwaukee is substantially higher: 41 percent if using the RMS data and 49 percent in the T7 TraCS data. While some low rate of erroneous stops is inevitable, it raises significant concerns that this rate is over 40 percent.

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[80] Two incidents were also excluded as duplicate records. After sampling, one incident involving a White subject was found to be misclassified as involving a Black subject. The race indicator for this record was updated accordingly.

[81] *See* Report of Jeffrey Fagan, Ph.D. at 4, Floyd v. City of New York, No. 08 Civ 01034 (S.D.N.Y. Oct. 15, 2010).

[82] *See* Plaintiffs' Eighth Report to Court and Monitor on Stop and Frisk Practices: Fourth Amendment Issues at 4, Bailey v. City of Philadelphia, C.A. No. 10-5952 (E.D. Pa. Jan. 5, 2018).

IX. PEDESTRIAN STOP ANALYSIS

85. In this section, I describe the pattern of pedestrian stops across MPD districts. Data on pedestrian stops (also known as "field interviews") from the RMS for the period January 2008 through April 2017 was produced by Defendants in the form of a spreadsheet titled "RMS Incidents Related to Calls for Services – FI."[83] As I will analyze pedestrian stop rates at the year-race-district level, I limit this data to full years after the 2009 redistricting, i.e. 2010 to 2016. Given severe concerns about data quality in parts of the data (see **Exhibit C-5** in **Appendix C**), I then exclude the years 2011 and 2012.[84] The RMS data contains information on the date and location of stops, as well as information on the race and ethnicity of individuals subject to pedestrian stops. According to a document by the MPD Office of Management, Analysis & Planning, RMS does not allow officers to record the ethnicity of a pedestrian stop subject as Latino or Hispanic; officers were instructed to record Hispanic individuals as "White" in these instances.[85] For the purposes of my analyses of pedestrian stops, I therefore focus on individuals with a recorded race of either "Black" or "White."

86. All of the analyses presented in this section are subject to serious data concerns. The findings are based on the subset of available data without obvious errors. This has several

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[83] Russell Letter, May 15, 2017, *supra* note 38. Pedestrian stop data was available from several sources. In **Appendix C,** I describe in detail the produced data and the construction of variables from the produced data for the purposes of my analyses. Defendants have indicated in discovery correspondence that data related to pedestrian stops is generally recorded in the RMS module, but there are some pedestrian stops that are documented in TraCS but not RMS. Russell Letter, July 5, 2017, *supra* note 33 (recognizing that Defendants' production of T7 and T10 TraCS data includes documentation of pedestrian stops that resulted in arrest or citation and that Defendants' production of Tiburon (RMS) data includes documentation of pedestrian stops that did not result in arrest or citation).

[84] The sparsity of RMS data on pedestrian stops for 2011 and 2012, as well as a distribution of stops across districts in those years that is out of line with the average over the period 2010 to 2016, suggests incomplete reporting of stops in RMS in 2012 and possibly 2011. In particular, the produced data includes no pedestrian stops of white individuals in Districts 4 and 6 in 2012.

[85] *See* MILWAUKEE POLICE DEP'T, FIELD INTERVIEWS, CONSENT SEARCHES, TRAFFIC STOP DATA COLLECTION & SSRS REPORTS (Dec. 18, 2015) (produced by Defendants) (MKE_0312367) ("Field Interview Cards in Tiburon do not capture Hispanic ethnicity. Therefore, officers enter individuals as White."); *id.* ("The Consent Search Form was poorly designed for analysis and much of the data is incomplete . . . .").

implications. The lack of reliable data in some years means the results may significantly understate overall pedestrian stops. The inability to distinguish Latino from white pedestrian stop subjects means that the analysis of ethnic disparities in pedestrian stops is necessarily incomplete. Further, while the produced data includes some information on consent searches associated with pedestrian stops, this data is also incomplete,[86] and the RMS dataset does not contain information on citations or warnings.[87] I am therefore unable to analyze the rate of searches following pedestrian stops or the rate of contraband discovery associated with pedestrian stop searches.

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[86] Of the 2010 and 2013 to 2016 pedestrian stops underlying my pedestrian stop rate analysis, 96.3 percent of stops lacked information about whether or not a consent search occurred. Defendants produced scans of physical cards documenting pedestrian stops (known as field interview cards) related to 40 incidents recorded in the MPD's Computer Aided Dispatch system that occurred between May 24, 2017 and October 15, 2017. *See* Milwaukee Police Dep't, District 7 Field Interview Cards (produced by Defendants on Oct. 26, 2017) (MKE_0609291). Of these pedestrian stops, 19 (47.5 percent) did not have any value indicating whether or not a consent search was involved. Defendants have indicated in discovery correspondence that some information relating to consent searches is documented in RMS data but that the data on consent searches is not necessarily complete. *See* Milwaukee Police Dep't, MPD Response to Plaintiff Questions and Data Requested from Meeting on 8/22/2017 ¶ 7 ("MPD is producing an additional data set that contains the property that was collected or seized from each traffic or pedestrian stop related incident that included a call for service. This data set will not directly answer if a consensual or non-consensual search was conducted.").

[87] Defendants indicated that data on citations could be found in TraCS, but that there is no direct link between the all data collected in RMS and TraCS. For confirmation that citation data is included in TraCS, see Russell Letter, July 5, 2017, *supra* note 33, at 3–4 (recognizing that T7 and T10 TraCS data produced by Defendants included only pedestrian stops that resulted in an arrest or citation, but that RMS data produced by Defendants concerned pedestrian stops that "did not result in an arrest or citation"). Plaintiffs requested an explanation of "how the different stop data spreadsheets produced by Defendants can be joined or merged to create separate and complete pedestrian and traffic stop data sets." Letter from Nusrat Choudhury, ACLU Found. to Joseph M. Russell and David A. Frank, von Briesen & Roper, s.c. and Grant F. Langley, Jan A. Smokowicz, and LaKeisha W. Butler, Milwaukee City Attorney's Office (July 14, 2017). Defendants responded, "MPD IT Division is unaware of a way to merge these documents." E-mail from Joseph M. Russell, von Briesen & Roper, s.c. to Nusrat J. Choudhury, ACLU Found. (Aug. 2, 2017, 4:13 PM) (attachment Milwaukee Police Dep't, MPD Response to Notice of Deposition ¶ 8). Despite these statements by Defendants, Plaintiffs were able to merge 3% of all provided RMS Field Interview observations to the TraCS dataset using the Computer Aided Dispatch ("CAD") call number. This percentage, however, was insufficient for robust analysis of citations using the TraCS data. An attempt to utilize the CAD dataset for arrest and citation data was also made, but only 34% of all provided RMS Field Interview observations were able to be merged with the CAD dataset, rendering it also insufficient for robust analysis.

A. Pedestrian Stops in Milwaukee are Concentrated in Predominately Black and Latino Neighborhoods

87. In this section, I describe the patterns of pedestrian stops across MPD districts. I start by determining the number of pedestrian stops per 100 residents in each district. The results of this analysis are presented in the top panel of **Exhibit 21**. The majority-white District 6 has the lowest rate of pedestrian stops. District 5, the most predominantly Black district, has the highest rate of pedestrian stops, followed by the majority-Black District 4.

B. Black Pedestrians Are More Likely to be Stopped Than White Pedestrians in All Districts

88. The empirical evidence presented above indicates that heavily-Black districts, particularly District 5 and District 4, are subject to a relatively high rate of pedestrian stops. In this section, I further analyze these trends to determine whether Black individuals are more likely to be subject to pedestrian stops and how the pattern of stops varies by race across districts.[88]

89. As a starting point, I calculate the pedestrian stop rate as the total number of pedestrian stops per resident, by race and year, over the years 2010 and 2013 to 2016. These rates are summarized in **Exhibit 22.** Across Milwaukee over this period, MPD officers subjected Black people to 4.1 pedestrian stops per 100 residents of the same race, as compared to 1.2 stops of white people per 100 residents of the same race. In other words, Black people are subjected to pedestrian stops at over three times the rate at which white people are subjected to pedestrian stops.

90. Second, I calculate the pedestrian stop rate by race and district. These rates are presented in table form in **Exhibit 21** and graphically in **Exhibit 23**. As these exhibits show, within each district in Milwaukee, Black pedestrians were more likely to be stopped than white/Latino pedestrians. Of particular note, Black people are subject to:

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[88] As noted above, the produced data on pedestrian stops does not distinguish between Latino/Hispanic people and non-Latino/Hispanic white people. This precludes a comparison of the pedestrian stop rates for Latino and white non-Latino people. See **Appendix C** for a more detailed description of the construction of the pedestrian stop data.

i. from seven to thirteen times as many pedestrian stops as white/Latino people in the primarily-white Districts 1 and 6; and

ii. from three to six times as many pedestrian stops as white/Latino people in the remaining five districts, which are predominately Black and Latino.

C. Pedestrian Stop Regression Analyses

91. As described above, the data produced by Defendants shows that Black people were stopped at a higher rate than white/Latino people, and that this disparity holds across districts. I now apply the same regression techniques that I used to analyze racial and ethnic disparities in traffic stop rates to check whether the disparities in pedestrian stop rates could be explained by non-racial factors.

92. The outcome of interest for these analyses is the pedestrian stop rate, which is defined as the total number of pedestrian stops per 100 individuals, by race, district, and year. I estimate the same four regression specifications as for traffic stops, adjusted to treat white and Latino people as a single group.[89,90]

93. The results of these regressions are presented graphically in **Exhibit 24**. A purple square marks the estimated difference in pedestrian stop rates between Black and white/Latino people according to each regression specification, and the black "whiskers" represent the 95 percent confidence interval for the estimate. After controlling for all the factors included in specification 4, Black people are stopped 6.6 more times per hundred people in comparison to white/Latino people. This difference is statistically significant at the 95 percent confidence level. For context, note that the average pedestrian stop rate for white and Latino people over the period 2010 and 2013 to 2016 is 1.1 stops per 100 people (**Exhibit D-9**, specification 1).

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[89] The MPD data on pedestrian stops does not provide separate classification of Latino individuals, and so my analysis can only address differences between pedestrian stops of the Black population and the combined white and Latino populations. See **Appendix C** for a more detailed description of the construction of the pedestrian stop data.

[90] Summary statistics of the variables included in these regressions are provided in **Appendix D**, **Exhibit D-8**.

As such, the additional 6.6 stops per 100 people associated with being Black is equivalent to an elevation in the stop rate of over 500 percent. Full regression results are provided in **Appendix D**, **Exhibit D-9**.

94. Note that the results of this regression analysis may be a conservative estimate of the pedestrian stop rate disparities experienced by Black people. In particular, if Latino people are also stopped at a higher rate than non-Latino white people—a difference we cannot ascertain here, given limitations of the produced data, but that has been found elsewhere[91]—then the combined white and Latino stop rate will overstate the non-Latino white stop rate. As a consequence, the difference between the Black and combined white/Latino stop rate will understate the difference between the Black and white stop rates.

X. CONCLUSIONS

95. My analysis of data produced by the Defendants provides evidence that MPD treatment of people in Milwaukee differs by race and ethnicity, and that differences persist after accounting for non-racial and non-ethnic factors. In particular, the MPD stops Black drivers at a higher rate than white drivers, and follows these traffic stops with a higher rate of searches of Black drivers as compared to white drivers. The fact that the discovery rate of drugs is significantly lower among Black and Latino drivers than white drivers implies that Black and Latino drivers are over-searched in comparison to white drivers. I find further evidence of race- and ethnicity-driven differences in MPD treatment of Milwaukee community members in the leniency that officers exercise—and withhold—when issuing speeding tickets. MPD officers exercise greater leniency toward white drivers than Black or Latino drivers when issuing tickets at lenient speeds, and these disparities are statistically significant even after controlling for other factors. The available data on pedestrian stops shows the stop rate of Black people to be several times that of white/Latino people, even

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[91] *See, e.g.*, Andrew Gelman, Jeffrey Fagan & Alex Kiss, *An Analysis of the New York City Police Department's "Stop-and-Frisk" Policy in the Context of Claims of Racial Bias*, j. of the am. statistical ass'n (Sep. 2007) (finding that both Black and Latino people were disproportionately targeted for pedestrian stops in New York City).

when controlling for non-racial factors. Further, the overall rate of stops lacking legal sufficiency—at least 40 percent—is extremely high, even compared to other large cities.

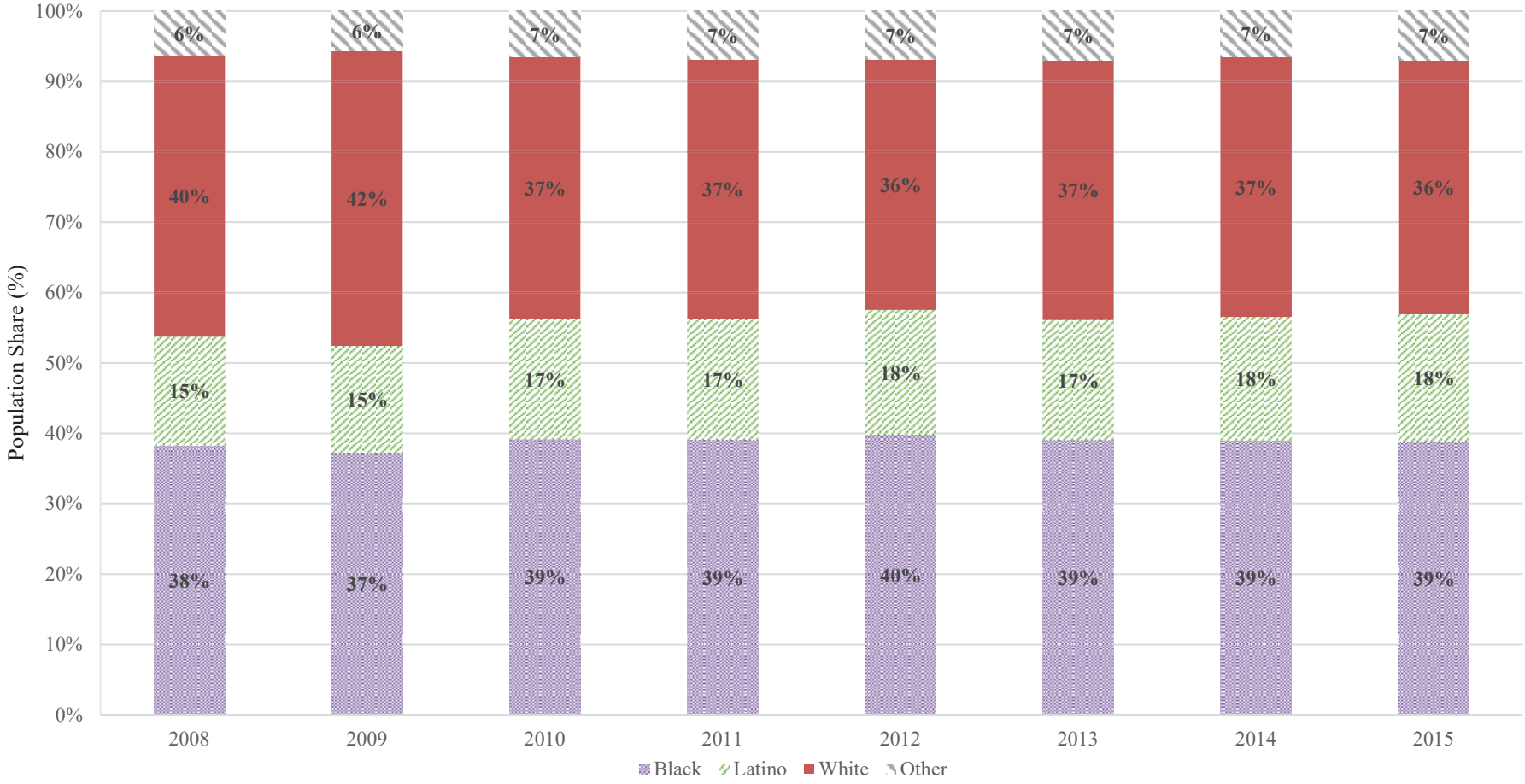
96. MPD data-keeping, moreover, is insufficient to monitor and analyze certain aspects of officer treatment of people in Milwaukee. In particular, the MPD does not record whether pedestrian stop subjects are Hispanic/Latino. This shortcoming in record-keeping prevents an examination of the difference, if any, in the pedestrian stop rate experienced by people of Latino and non-Latino ethnicity.

97. Finally, MPD data-keeping is even more deficient concerning frisks. The MPD does not systematically track frisks and therefore lacks even basic information about the number of frisks conducted throughout the City, the race and ethnicity of frisk subjects, and the reasons offered by officers to justify frisks. This absence of data precludes an analysis of MPD frisk practices, such as a determination of the rate of unjustified frisks citywide or by police district, whether the rate of unjustified frisks differs across racial and ethnic groups, and whether Black and Latino people are more likely to be frisked in the course of a stop, even after accounting for demographic and crime-related factors. Additionally, without such basic data about frisks, the MPD cannot examine the difference, if any, in the rate of contraband seizures during frisks experienced by people of different racial and ethnic groups. Such data collection has become standard practice in police forces across the country. In order to better understand its own policing practices, as well as to keep the public informed, additional and refined data collection should be undertaken by the MPD regardless of the outcome of this litigation.

Executed on February 20, 2018.

David Abrams, Ph.D.

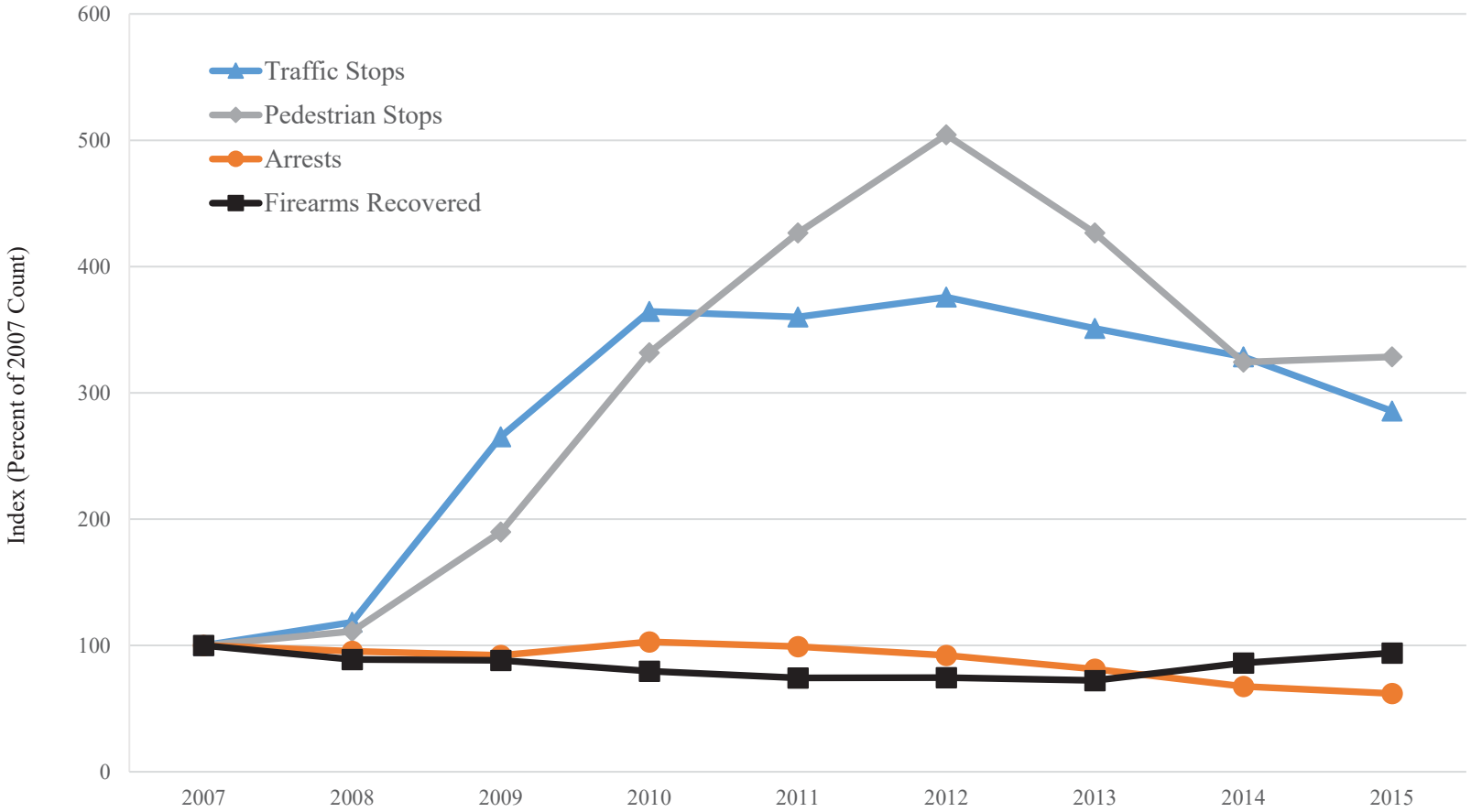
Exhibit 1
Distribution of Milwaukee Population by Race and Ethnicity
2008–2015



Note:
[1] "Other" includes all individuals with a self-reported race and/or ethnicity other than Black, Hispanic or Latino, or white.

Source:
[1] U.S. Census, American Community Survey, 2008–2015.

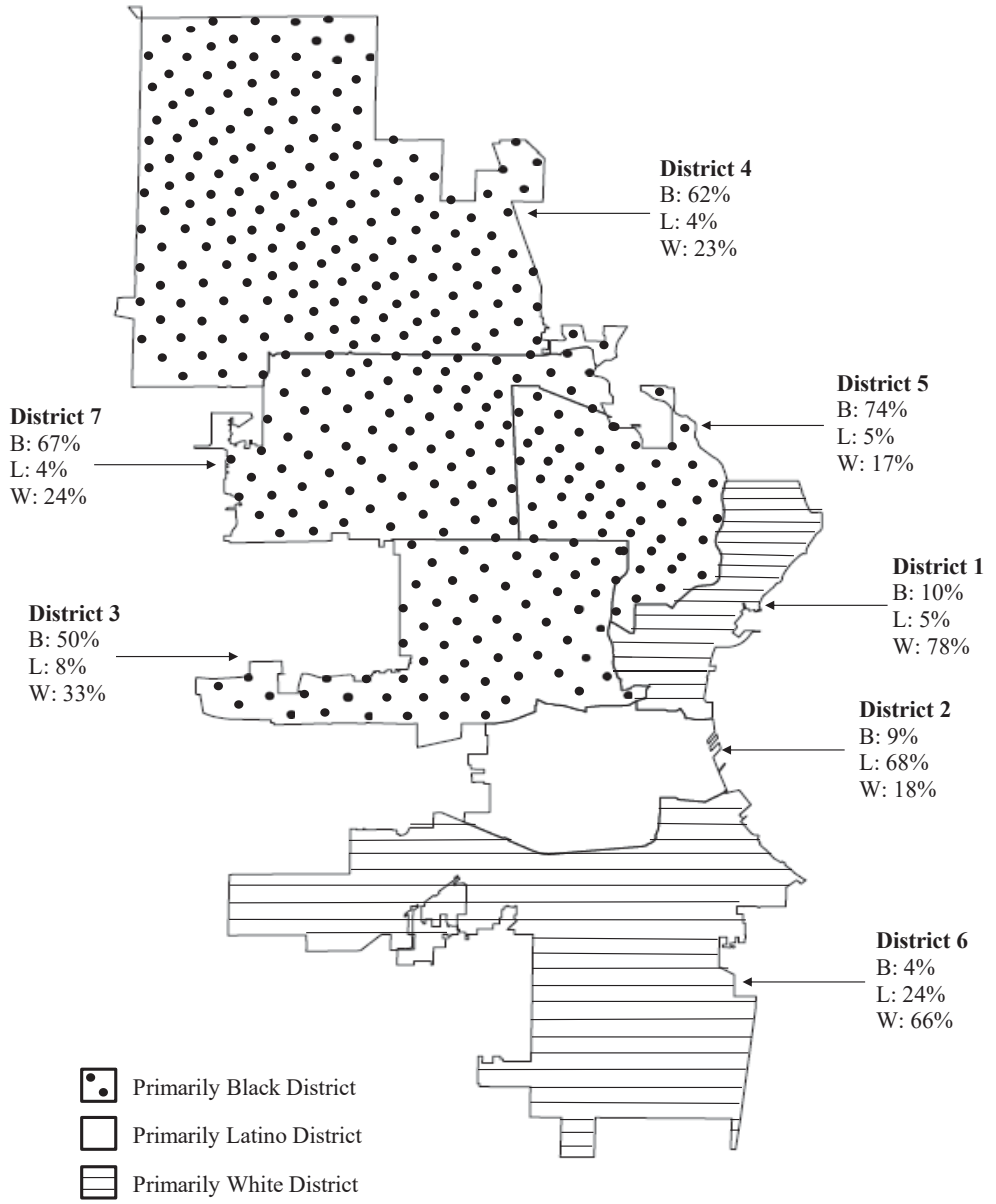
Exhibit 2
Milwaukee Police Department Traffic Stops, Pedestrian Stops, Arrests, and Firearm Recovery
2007–2015



Note:
[1] "Index" measures the relationship of each count (traffic stops, pedestrian stops, arrests, and firearms recovered) to its value in 2007. A traffic stop index of 376 in 2012, for example, indicates that the traffic stop count in 2012 is 376 percent of the traffic stop count in 2007. In other words, the traffic stop count increased 276 percent—376 percent minus 100 percent—from 2007 to 2012.

Source:
[1] Milwaukee Police Department, Annual Report 2015, p. 12, available at http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/Archive-Annual-Reports/2015MPDAR58forWEB.pdf.

Exhibit 3
Share of Population by Race and Ethnicity in Police Districts
2011–2015

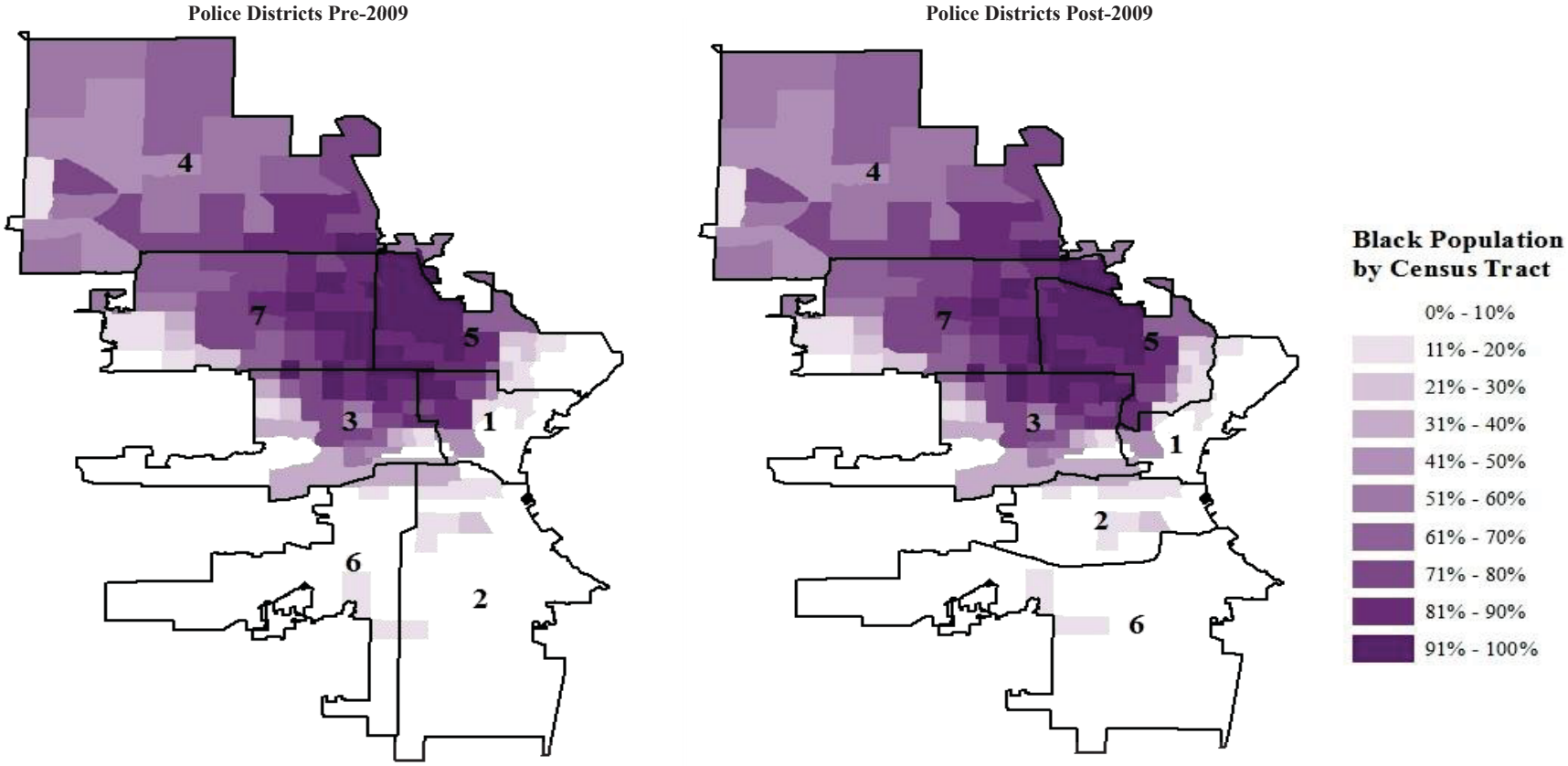


Sources:

[1] U.S. Census Bureau, 2011–2015 American Community Survey 5-Year Estimates, "Hispanic or Latino Origin By Race" (B03002), available at http://factfinder2.census.gov.

[2] Official Website of the City of Milwaukee, Map Milwaukee Portal, MPD_police_district, July 2009, available at http://city.milwaukee.gov/DownloadMapData3497.htm#.WiBcSoWcESt.

Exhibit 4A
Black Population by Census Tract and MPD Districts



Note:

[1] Changes to MPD district boundaries became effective on July 12, 2009. See http://itmdapps.milwaukee.gov/publicApplication_SR/policeDistrict/policeDistrictfm.faces.

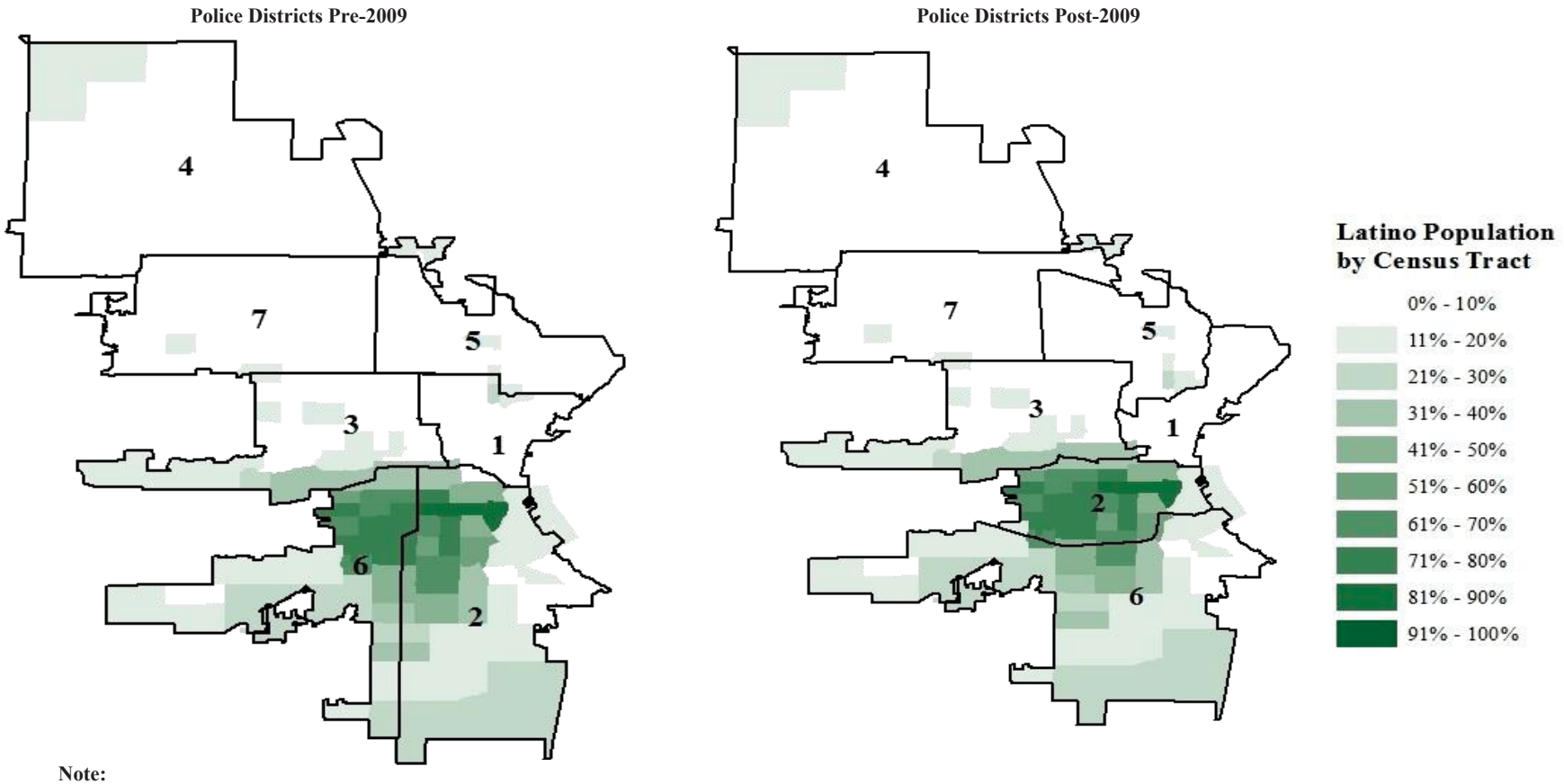
[2] In both maps, the Black share of the Census tract population is based on the 2011–2015 ACS 5-Year Estimates.

Sources:

[1] Milwaukee Police Department, 2009 Annual Report, p. 5, available at http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/Documents/2009_Annual_Report.pdf.

[2] U.S. Census, American Community Survey 5-Year Estimates, 2011–2015.

Exhibit 4B
Latino Population by Census Tract and MPD Districts



Note:
[1] Changes to MPD district boundaries became effective on July 12, 2009. See http://itmdapps.milwaukee.gov/publicApplication_SR/policeDistrict/policeDistrictfm.faces.
[2] In both maps, the Latino share of the Census tract population is based on the 2011–2015 ACS 5-Year Estimates.

Sources:
[1] Milwaukee Police Department, 2009 Annual Report, p. 5, available at http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/Documents/2009_Annual_Report.pdf.
[2] U.S. Census, American Community Survey 5-Year Estimates, 2011–2015.

Exhibit 5
Traffic Stops per 100 Drivers by Race, Ethnicity, and District
2011–2015

	District							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Citywide**
Traffic Stops per 100 Drivers	31	65	64	27	71	19	41	40
Traffic Stops per 100 Black Drivers	164	245	124	40	99	81	62	77
Traffic Stops per 100 Latino Drivers	64	66	47	21	45	42	29	53
Traffic Stops per 100 White Drivers	20	34	17	8	25	12	9	15
Black Share of Residential Population	11%	9%	55%	69%	77%	4%	71%	42%
Latino Share of Residential Population	5%	72%	9%	5%	5%	25%	4%	19%
White Share of Residential Population	84%	19%	36%	26%	18%	70%	25%	39%

Notes:

[1] The Black traffic stop rate in each district is the average of the Black traffic stop rates in each year 2011–2015. The Black traffic stop rate in each district and year is calculated as the total number of traffic stops of Black drivers in that district and year, multiplied by 100, and divided by the number of Black drivers in that district. The white and Latino traffic stop rates are calculated similarly.

[2] The overall traffic stop rate in each district is the average of the overall traffic stop rates in each year 2011–2015. The overall traffic stop rate in each district and year is calculated as the total number of traffic stops of white, Latino, and Black people in that district and year, multiplied by 100, and divided by the number of white, Latino, and Black drivers in that district. This overall traffic stop rate omits drivers of "other" race/ethnicity from both the numerator and the denominator.

[3] The citywide Black, Latino, white, and overall traffic stop rates are the average of the corresponding citywide traffic stop rates in each year 2011–2015. The annual citywide traffic stop rates are calculated as the total number of traffic stops of drivers of the relevant race or ethnicity in that year, across all of Milwaukee, multiplied by 100, and divided by the total number of drivers of the relevant race or ethnicity in Milwaukee.

[4] The Black, Latino, and white shares of residential population are based on data for Black, Latino, and white residents, omitting residents of other races/ethnicities.

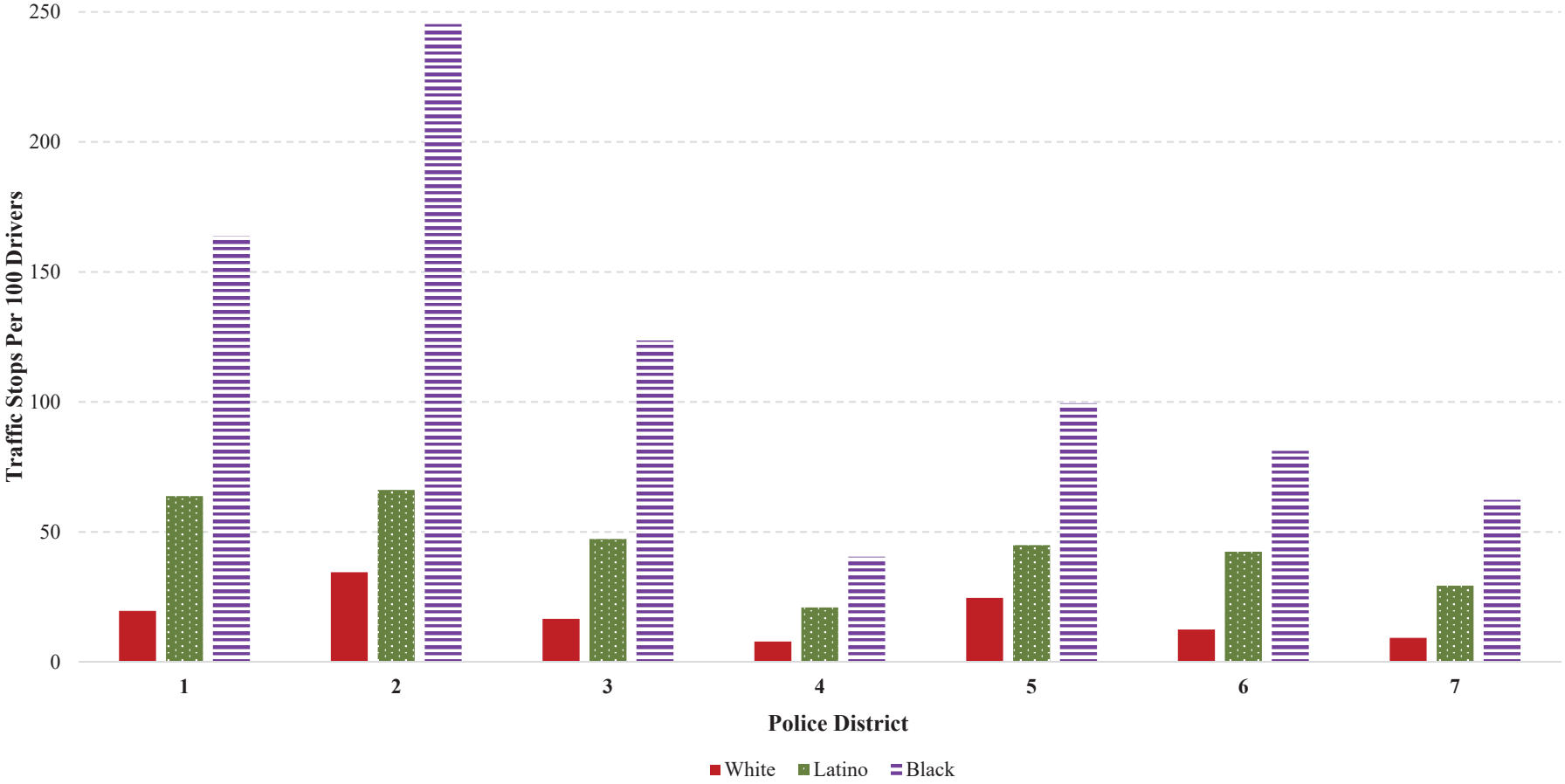
Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Wisconsin Driver License Data.

[3] U.S. Census, American Community Survey 5-Year Estimates, 2011–2015.

Exhibit 6
Traffic Stop Rate by Driver Race/Ethnicity and District
2011–2015



Note:
[1] This graph shows the traffic stop rate per 100 drivers, by race and ethnicity, in each MPD district. Traffic stop rates are averaged over the years 2011–2015.

Sources:
[1] T7 TraCS traffic stop data, 2011–2015.
[2] Driver license and mapping data, as discussed in the report text and Appendix C.

Exhibit 7
Traffic Stops per 100 Drivers of the Same Race and Ethnicity
2011–2015

	2011	2012	2013	2014	2015	Average
Black	37	69	95	110	76	77
Latino	24	50	82	65	42	53
White	9	16	21	20	12	15

Ratio of Black and Latino Traffic Stop Rates to White Traffic Stop Rate
2011–2015

	2011	2012	2013	2014	2015	Average
Ratio of Black Stop Rate to White Stop Rate	4.2	4.4	4.5	5.6	6.2	5.0
Ratio of Latino Stop Rate to White Stop Rate	2.8	3.2	3.9	3.3	3.4	3.3

Notes:

[1] Traffic stops per 100 Black drivers in 2011 is calculated as the total number of traffic stops of Black drivers in Milwaukee in 2011, multiplied by 100, and divided by the total number of Black drivers in Milwaukee in 2011. Similar calculations are performed for Latino and white traffic stops and in all other years.

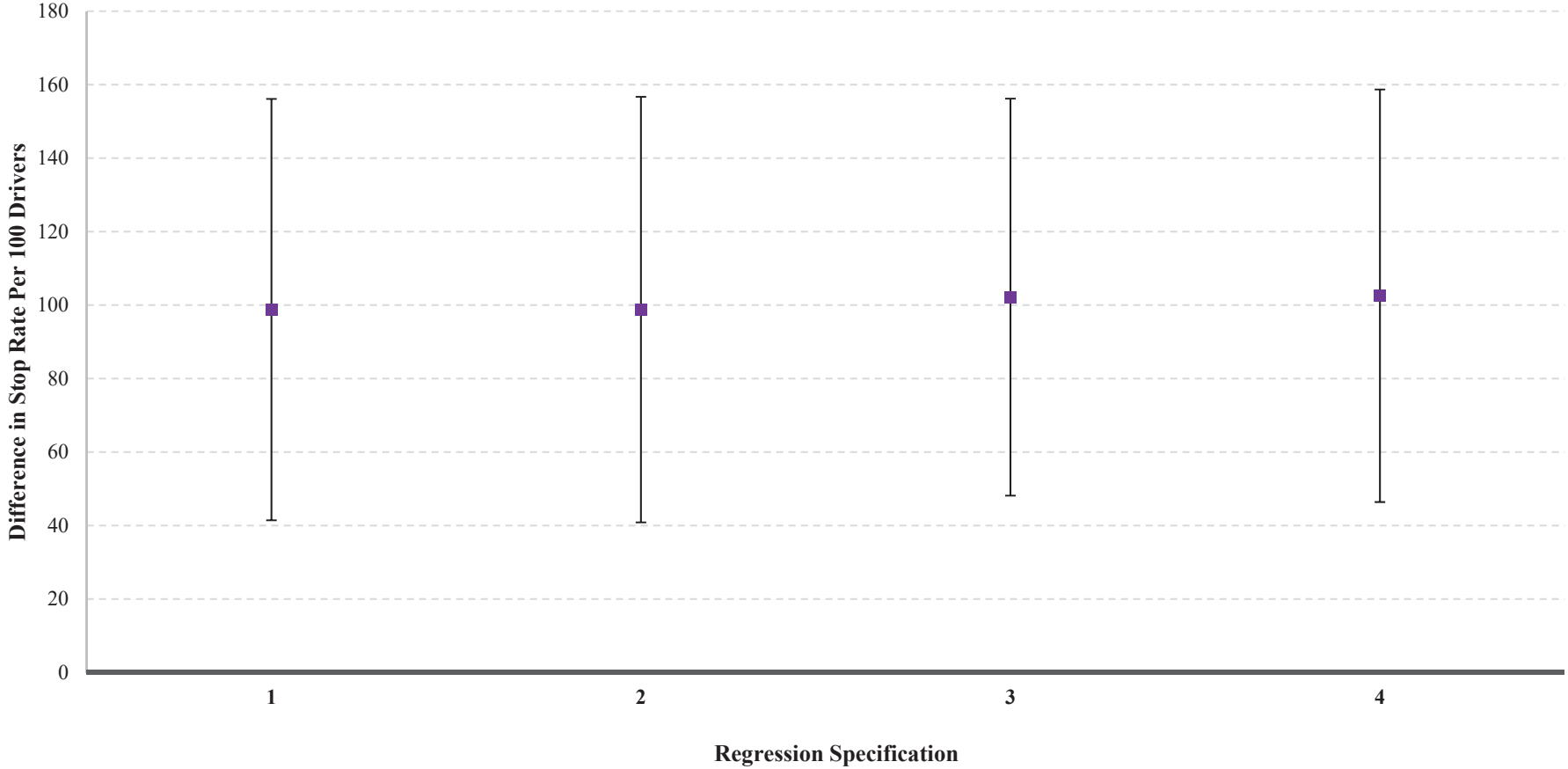
[2] The ratio of the Black stop rate to the white stop rate is calculated for each year as the number of traffic stops per 100 Black drivers divided by the number of traffic stops per 100 white drivers. Similar calculations are performed for the ratio of the Latino stop rate to the white stop rate.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Wisconsin Driver License Data.

Exhibit 8A
Estimated Difference in Traffic Stop Rate for Black Drivers, as Compared to White Drivers
2011–2015



Notes:

[1] This graph shows the estimated difference in the rate at which Black and white drivers are subject to traffic stops (purple square) and the 95 percent confidence interval for this estimate (black whiskers).

[2] Estimates are presented for each of the regression specifications discussed in the report text.

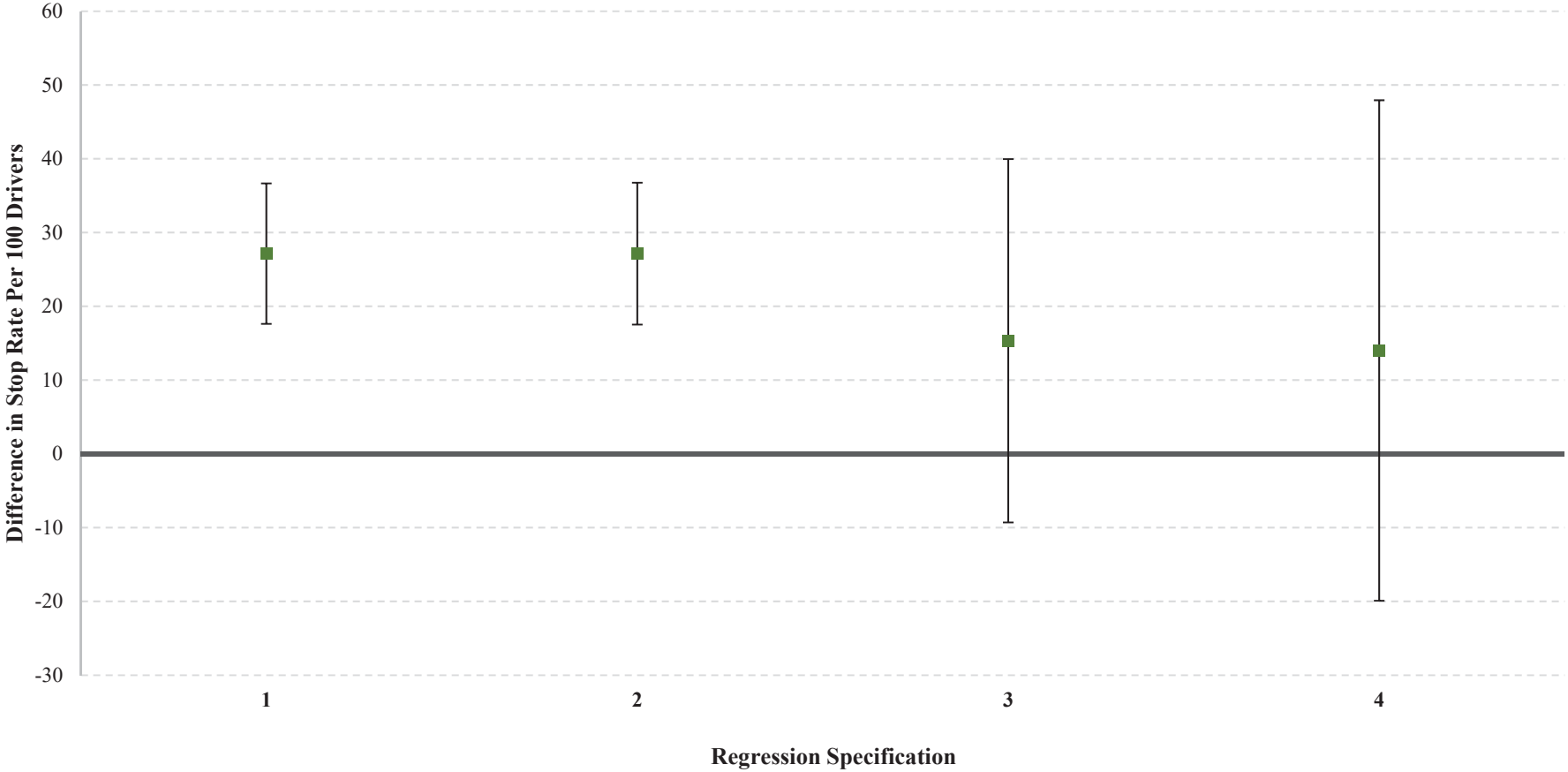
[3] Traffic stop rates are per hundred licensed drivers. An estimated difference of 100, for example, implies that the traffic stop rate is higher for Black drivers than white drivers by 100 stops per hundred licensed drivers.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Demographic, crime, driver license, and mapping data, as discussed in the report text and Appendix C.

Exhibit 8B
Estimated Difference in Traffic Stop Rate for Latino Drivers, as Compared to White Drivers
2011–2015



Notes:
[1] This graph shows the estimated difference in the rate at which Latino and white drivers are subject to traffic stops (green square) and the 95 percent confidence interval for this estimate (black whiskers).
[2] Estimates are presented for each of the regression specifications discussed in the report text.
[3] Traffic stop rates are per hundred licensed drivers. An estimated difference of 15, for example, implies that the traffic stop rate is higher for Latino drivers than white drivers by 15 stops per hundred licensed drivers.

Sources:
[1] T7 TraCS traffic stop data, 2011–2015.
[2] Demographic, crime, driver license, and mapping data, as discussed in the report text and Appendix C.

Exhibit 9A
Traffic Stop Searches and Contraband Discovery by Race and Ethnicity
2011–2015

Driver Race	Searches	Contraband Found	Contraband Discovery Rate Per Search	Difference in Discovery Rate Per Search, As Compared to White Drivers
Black	10,728	2,926	27.27%	-0.93%
Latino	1,930	494	25.60%	-2.61%
White	1,826	515	28.20%	
Total	14,484	3,935	27.17%	

Notes:

[1] "Contraband Discovery Rate Per Search," the proportion of searches that result in the discovery of contraband, is calculated as (Contraband Found)/Searches.

[2] "Difference in Discovery Rate Per Search, As Compared to White Drivers" is calculated as the contraband discovery rate per search for Black or Latino drivers, as appropriate, minus the contraband discovery rate per search for white drivers.

Source:

[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit 9B
Traffic Stop Searches and Contraband Discovery by District
2011–2015

District	Searches	Search Rate Per Stop	Contraband Found	Contraband Discovery Rate Per Search
District 1	473	1.01%	125	26.43%
District 2	2,490	2.93%	520	20.88%
District 3	3,055	2.90%	885	28.97%
District 4	933	1.43%	251	26.90%
District 5	3,306	3.29%	856	25.89%
District 6	1,097	1.68%	363	33.09%
District 7	3,130	2.77%	935	29.87%
Total	14,484	2.49%	3,935	27.17%

Notes:
[1] "Search Rate Per Stop" is the proportion of stops that involve searches.
[2] "Contraband Discovery Rate Per Search" is the proportion of searches that result in the discovery of contraband.

Source:
[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit 9C
Drugs and Weapons Discovered in Traffic Stop Searches by District
2011–2015

District	Drugs Found	Drug Discovery Rate Per Search	Weapon Found	Weapon Discovery Rate Per Search
District 1	67	14.16%	19	4.02%
District 2	259	10.40%	53	2.13%
District 3	569	18.63%	126	4.12%
District 4	164	17.58%	36	3.86%
District 5	520	15.73%	121	3.66%
District 6	295	26.89%	17	1.55%
District 7	667	21.31%	90	2.88%
Total	2,541	17.54%	462	3.19%

Note:
[1] "Drug Discovery Rate Per Search" and "Weapon Discovery Rate Per Search" are the proportions of searches that result in the discovery of drugs and weapons, respectively.

Source:
[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit 10
Estimation Results:
Probability of Contraband Discovery During Traffic Stop Search

Dependent Variable: Indicator Variable for Contraband Discovery * 100	[1]	[2]	[3]	[4]
Black Driver	-0.967	-1.106	-0.517	-2.112
	(2.155)	(2.012)	(1.964)	(1.182)
Latino Driver	-2.626**	-2.780**	-2.935**	0.807
	(1.011)	(0.928)	(1.033)	(1.483)
Male Driver		1.629	1.409	1.856
		(1.622)	(1.619)	(1.554)
Age of Driver		0.00271	0.0140	0.0276
		(0.0779)	(0.0741)	(0.0659)
Time-of-Day Fixed Effects			X	X
Year Fixed Effects				X
District Fixed Effects				X
Constant	28.23***	26.80***	16.54***	13.00***
	(2.669)	(4.056)	(3.447)	(2.235)
Observations	14,480	14,480	14,480	14,480

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] Observations in the data are at the level of the individual driver search.

[3] The dependent variable is an indicator variable equal to one if contraband was discovered and zero otherwise, times 100.

[4] Each variable's coefficient measures its relationship with the rate of contraband discovery per 100 traffic stop searches.

[5] Subjects stopped with a race of Asian or Indian are excluded.

[6] Time-of-day fixed effects are indicator variables for the quarter of the day in which the stop occurred (9:00 am–2:59 pm, 3:00 pm–8:59 pm, 9:00 pm–2:59 am, 3:00 am–8:59 am).

[7] Standard errors are clustered by MPD district.

[8] In specification 1, the constant provides an estimate of the contraband discovery rate in traffic stop searches of white drivers.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Mapping data, as discussed in the report text and Appendix C.

Exhibit 11
Estimation Results:
Probability of Drug Discovery During Traffic Stop Search

Dependent Variable: Indicator for Drug Discovery * 100	[1]	[2]	[3]	[4]
Black Driver	-3.682	-4.689*	-4.345	-4.891***
	(2.591)	(2.356)	(2.354)	(1.174)
Latino Driver	-7.117***	-8.026***	-8.051***	-4.608***
	(1.585)	(1.389)	(1.349)	(0.860)
Male Driver		-0.000334	-0.176	0.321
		(1.033)	(1.007)	(0.872)
Age of Driver		-0.282***	-0.277***	-0.258***
		(0.0604)	(0.0577)	(0.0527)
Time-of-Day Fixed Effects			X	X
Year Fixed Effects				X
District Fixed Effects				X
Constant	21.22***	29.94***	24.63***	17.70***
	(2.901)	(3.422)	(2.832)	(1.317)
Observations	14,480	14,480	14,480	14,480

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] Observations in the data are at the level of the individual driver search.

[3] The dependent variable is an indicator variable equal to one if drugs were discovered and zero otherwise, times 100.

[4] Each variable's coefficient measures its relationship with the rate of drug discovery per 100 traffic stop searches.

[5] Subjects stopped with a race of Asian or Indian are excluded.

[6] Time-of-day fixed effects are indicator variables for the quarter of the day in which the stop occurred (9:00 am–2:59 pm, 3:00 pm–8:59 pm, 9:00 pm–2:59 am, 3:00 am–8:59 am).

[7] Standard errors are clustered by MPD district.

[8] In specification 1, the constant provides an estimate of the drug discovery rate in traffic stop searches of white drivers.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Mapping data, as discussed in the report text and Appendix C.

Exhibit 12
Estimation Results:
Probability of Weapon Discovery During Traffic Stop Search

Dependent Variable: Indicator Variable for Weapon Discovery * 100	[1]	[2]	[3]	[4]
Black Driver	1.122	0.819	0.877	0.282
	(0.621)	(0.704)	(0.709)	(0.729)
Latino Driver	-0.808	-1.106*	-1.130*	-0.847
	(0.440)	(0.540)	(0.533)	(0.552)
Male Driver		1.335*	1.320*	1.422**
		(0.548)	(0.542)	(0.554)
Age of Driver		-0.0505**	-0.0491**	-0.0504**
		(0.0150)	(0.0149)	(0.0157)
Time-of-Day Fixed Effects			X	X
Year Fixed Effects				X
District Fixed Effects				X
Constant	2.467***	2.923***	1.814**	1.756
	(0.400)	(0.609)	(0.646)	(1.020)
Observations	14,480	14,480	14,480	14,480

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] Observations in the data are at the level of the individual driver search.

[3] The dependent variable is an indicator variable equal to one if a weapon was discovered and zero otherwise, times 100.

[4] Each variable's coefficient measures its relationship with the rate of weapon discovery per 100 traffic stop searches.

[5] Subjects stopped with a race of Asian or Indian are excluded.

[6] Time-of-day fixed effects are indicator variables for the quarter of the day in which the stop occurred (9:00 am–2:59 pm, 3:00 pm–8:59 pm, 9:00 pm–2:59 am, 3:00 am–8:59 am).

[7] Standard errors are clustered by MPD district.

[8] In specification 1, the constant provides an estimate of the weapon discovery rate in traffic stop searches of white drivers.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Mapping data, as discussed in the report text and Appendix C.

Exhibit 13
Traffic Stops and Searches by Race
2011–2015

Driver Race	Stops	Searches	Searches per Stop
Black	381,173	10,728	2.81%
Latino	73,478	1,930	2.63%
White	126,336	1,826	1.45%
Total	580,987	14,484	2.49%

Source:
[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit 14
Estimation Results: Search Rate Given Traffic Stop

Dependent Variable: Indicator Variable for Search * 100	[1]	[2]	[3]	[4]
Black Driver	1.371***	1.007**	1.052**	0.728**
	(0.358)	(0.389)	(0.373)	(0.261)
Latino Driver	1.181***	0.553	0.517	0.166
	(0.257)	(0.340)	(0.341)	(0.153)
Male Driver		2.914***	2.730***	2.695***
		(0.360)	(0.333)	(0.337)
Age of Driver		-0.0826***	-0.0749***	-0.0751***
		(0.0122)	(0.0114)	(0.0108)
Description: Speed Violation			0.330	0.261
			(0.247)	(0.283)
Description: Vehicle Registration			0.186	0.869***
			(0.316)	(0.232)
Description: Seat Belt			6.724***	6.677***
			(0.733)	(0.720)
Description: Impaired Driving			3.065***	2.094**
			(0.639)	(0.726)
Description: Vehicle Equipment Violation			-0.0707	0.701***
			(0.218)	(0.172)
Description: Stolen Auto			27.55***	28.38***
			(7.068)	(7.039)
Description: Burglary Investigation			3.543***	2.741***
			(0.738)	(0.575)
Description: Other Rules of the Road			1.305***	2.073***
			(0.352)	(0.298)
Time-of-Day Fixed Effects			X	X
Year Fixed Effects				X
District Fixed Effects				X
Constant	1.444***	2.644***	1.194	1.726**
	(0.267)	(0.502)	(0.634)	(0.628)
Observations	580,816	580,816	580,816	580,816

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] Observations in the data are at the level of the individual traffic stop.

[3] The dependent variable is an indicator variable equal to one if the subject was searched and zero otherwise, times 100.

[4] Each variable's coefficient measures its relationship with the rate of searches per 100 traffic stops.

[5] Subjects stopped with a race of Asian or Indian are excluded.

[6] Time-of-day fixed effects are indicator variables for the quarter of the day in which the stop occurred (9:00 am–2:59 pm, 3:00 pm–8:59 pm, 9:00 pm–2:59 am, 3:00 am–8:59 am).

[7] Standard errors are clustered by MPD district.

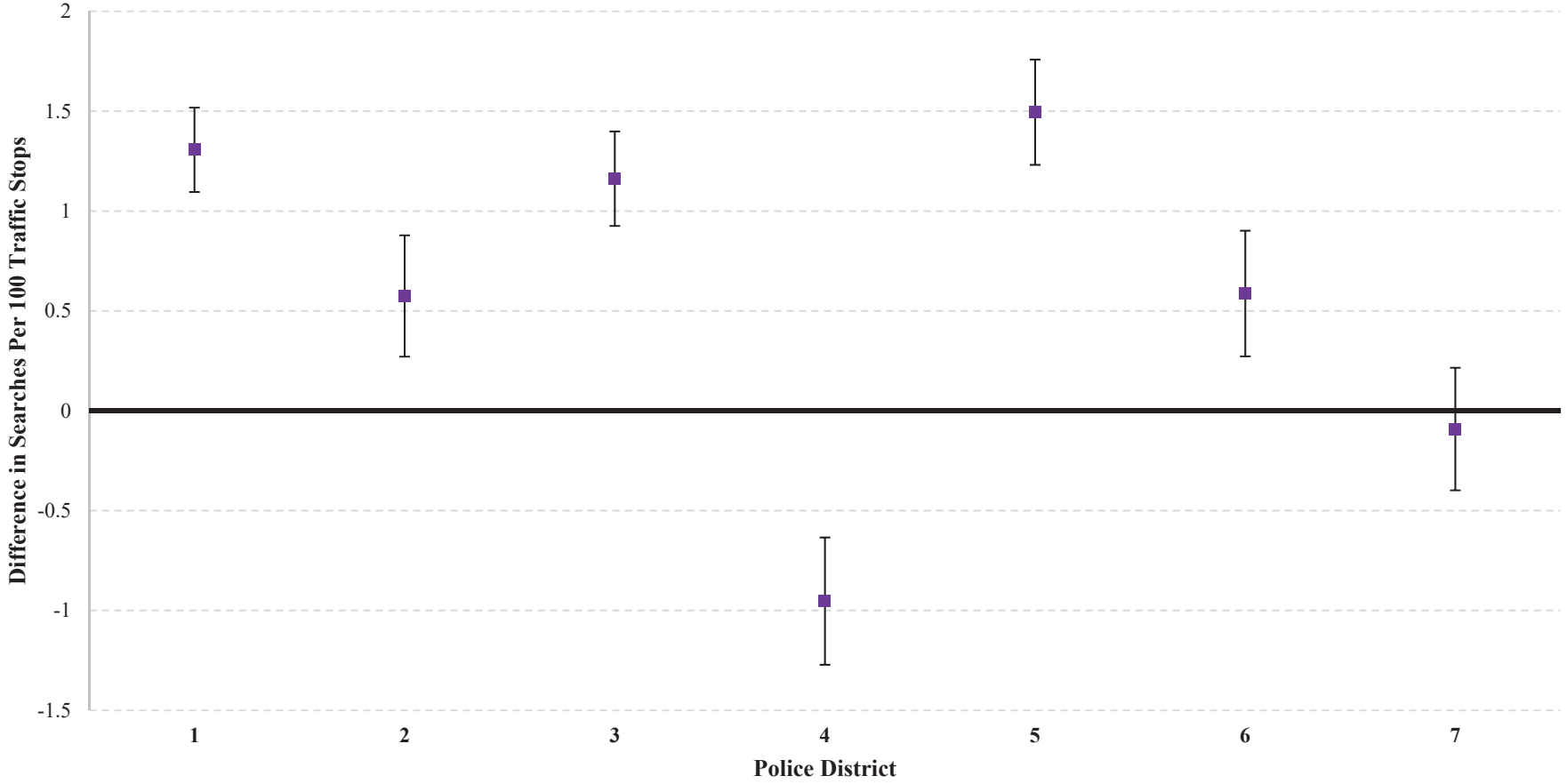
[8] In specification 1, the constant provides an estimate of the white traffic stop search rate.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Mapping data, as discussed in the report text and Appendix C.

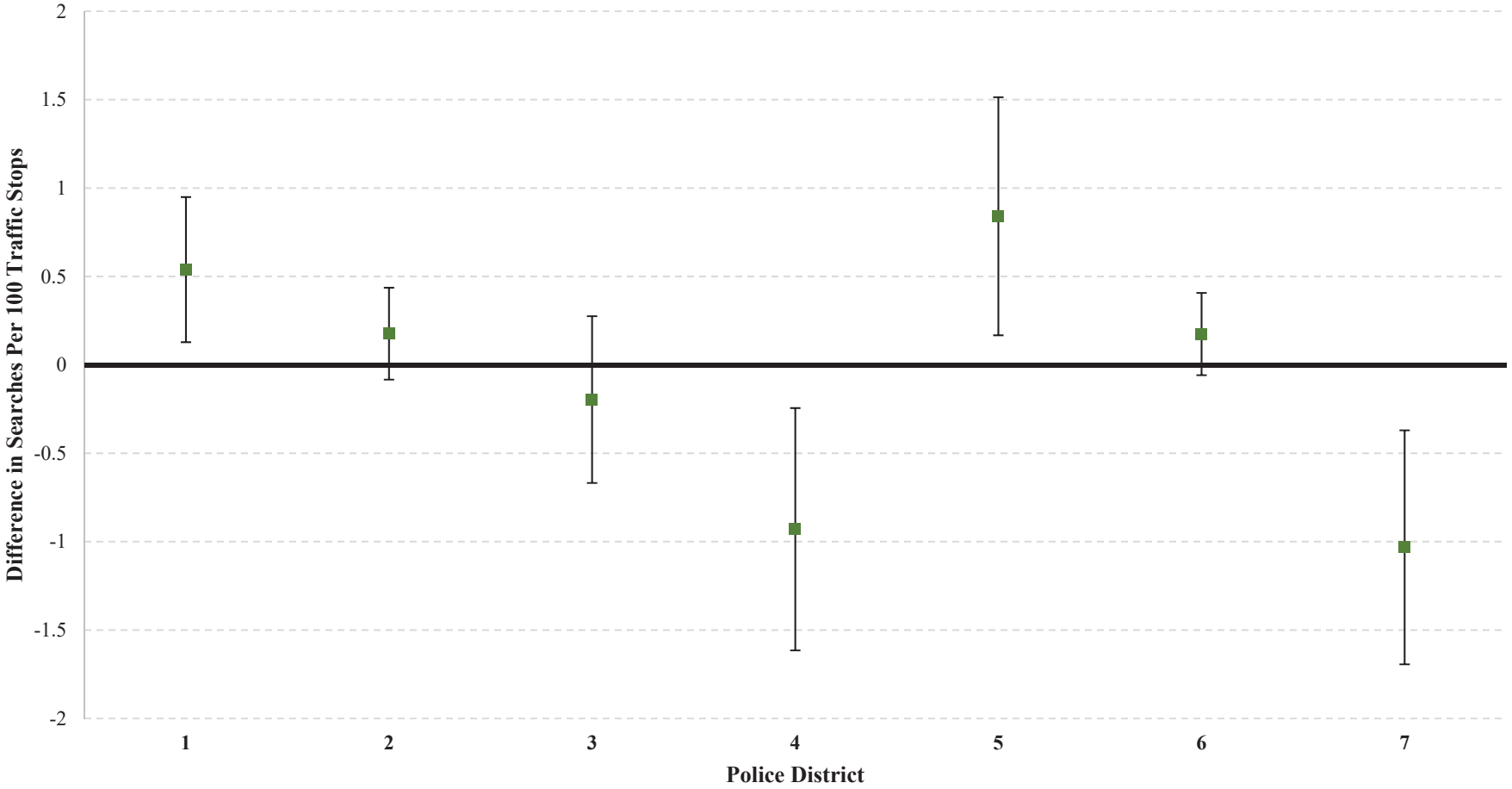
Exhibit 15A
Difference in Search Rate Given Traffic Stop for Black Drivers, As Compared to White Drivers, by District



Notes:
[1] This graph shows the estimated difference in the probability that a Black driver, as compared to a white driver, is searched if subjected to a traffic stop. The point estimate of this difference is plotted as a purple square, and the 95% confidence interval is represented by black whiskers.
[2] Estimates are presented for specification 4 of the district-specific version of the search-rate regression.

Sources:
[1] T7 TraCS traffic stop data, 2011–2015.
[2] Mapping data, as discussed in the report text and Appendix C.

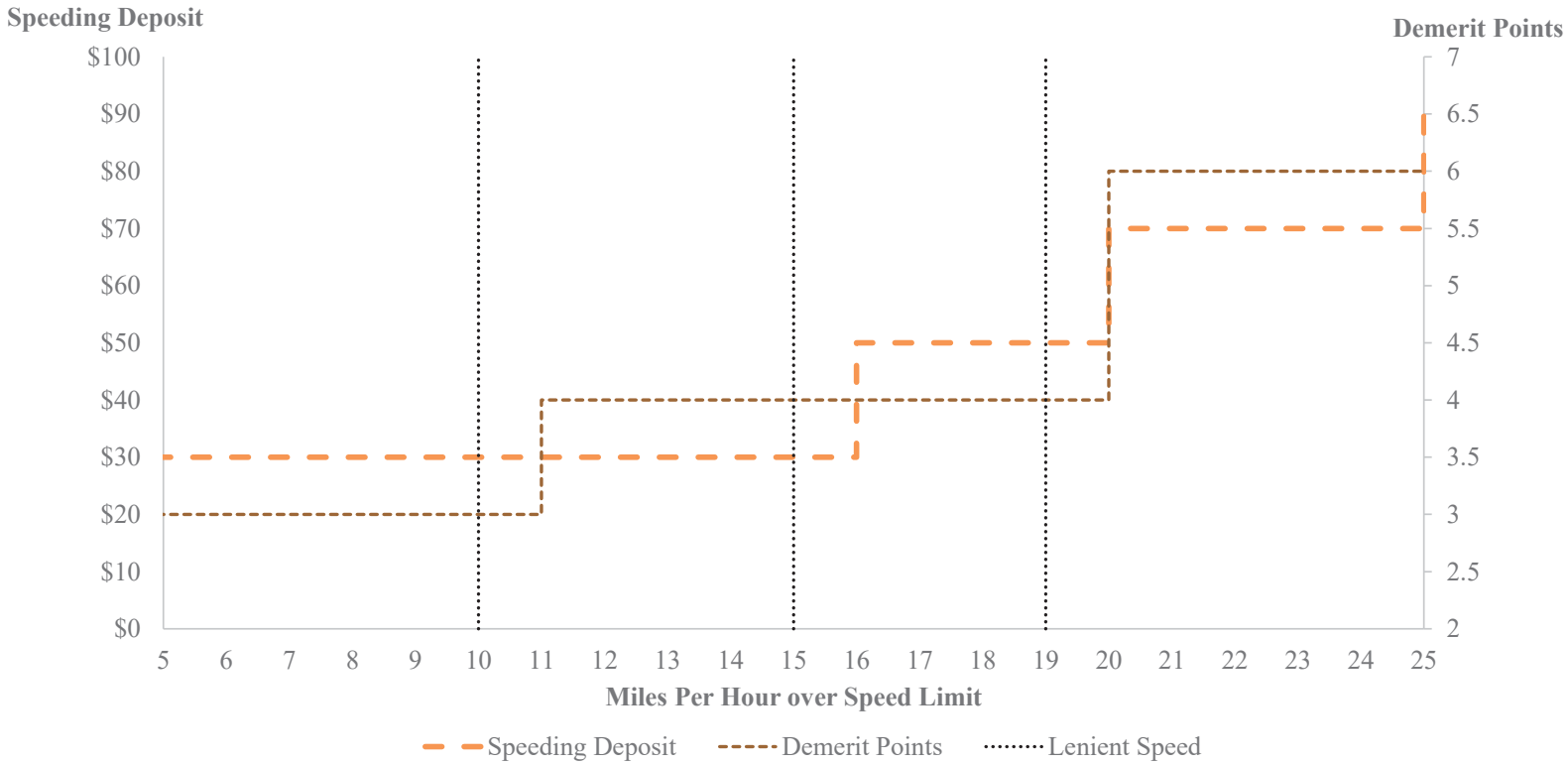
Exhibit 15B
Difference in Search Rate Given Traffic Stop for Latino Drivers, As Compared to White Drivers, by District



Notes:
[1] This graph shows the estimated difference in the probability that a Latino driver, as compared to a white driver, is searched if subjected to a traffic stop. The point estimate of this difference is plotted as a green square, and the 95% confidence interval is represented by black whiskers.
[2] Estimates are presented for specification 4 of the district-specific version of the search-rate regression.

Sources:
[1] T7 TraCS traffic stop data, 2011–2015.
[2] Mapping data, as discussed in the report text and Appendix C.

Exhibit 16
Wisconsin Speeding Deposit Schedule and Demerit Points Schedule



Notes:

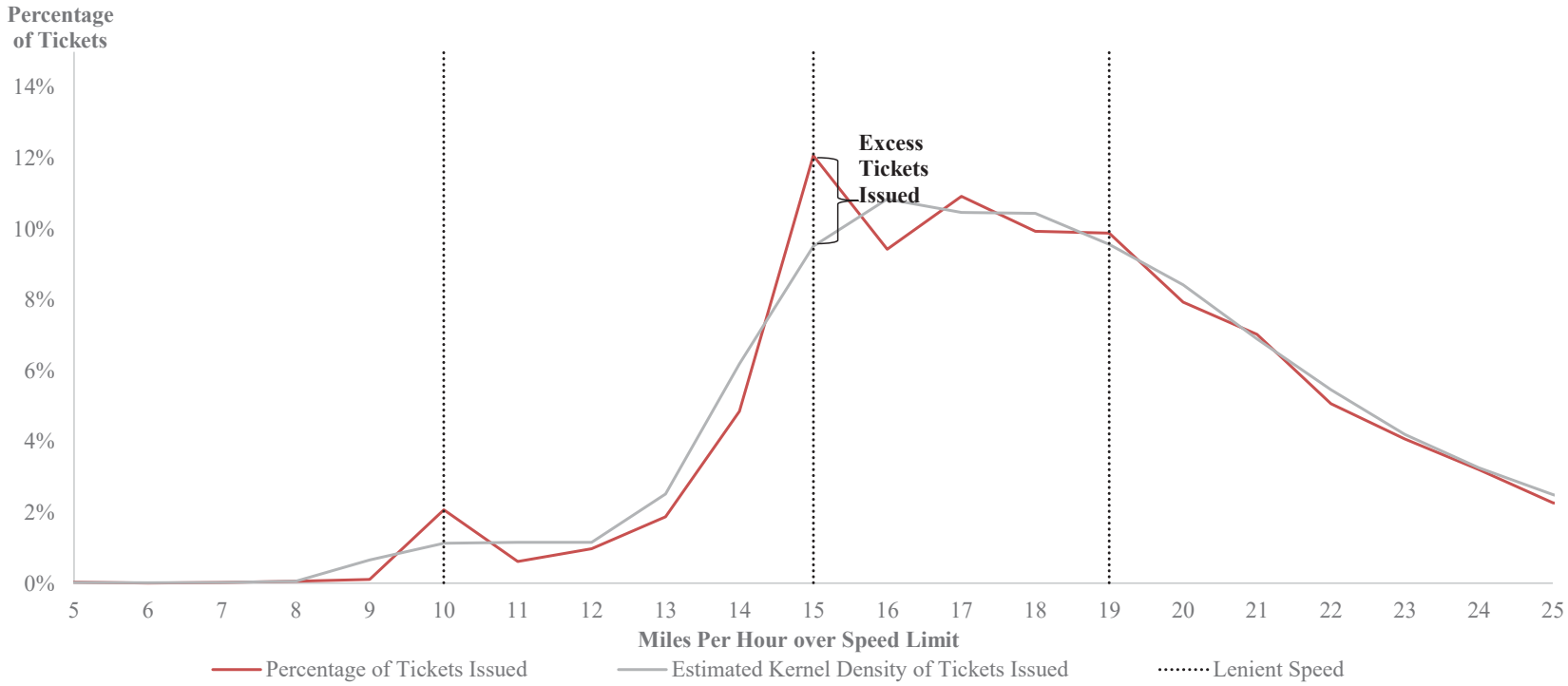
[1] This graph shows Wisconsin's speeding deposit and demerit points schedules for tickets issued for driving at speeds between 5 and 25 mph over the speed limit on roads with fixed limits.

[2] Dotted black lines indicate "lenient speeds," or speeds immediately below the threshold for an increase in fine and/or demerit points. Officers may exercise leniency by issuing a ticket for a speed associated with lower penalties than the speed measured.

Source:

[1] Speeding Deposits and Demerit Points schedule from Section 346.57(4) of the 2017 State of Wisconsin Revised Uniform State Traffic Deposit Schedule, available at https://wicourts.gov/publications/fees/docs/bondsched17.pdf, at 44–46.

Exhibit 17A
Distribution of Recorded and Estimated Excess Speed on Speeding Tickets
All Drivers
Jan. 2010–Jun. 2017



Notes:

[1] The actual percentage of tickets issued for each mile per hour in excess of the speed limit in the produced ELCI data ("Percentage of Tickets Issued") is shown in red. A kernel density estimate of this distribution, which smooths out the spikes in the data, is shown in grey ("Estimated Kernel Density of Tickets Issued"). For example, 2 percent of actual tickets were issued for driving 10 mph above the speed limit, whereas the estimated kernel density predicts 1 percent of tickets to be issued at this excess speed.

[2] Spikes in the percentage of actual tickets, in comparison to the estimated kernel density, are apparent at the lenient excess speeds of 10 and 15 mph over the speed limit.

[3] "Percentage of Tickets Issued" is calculated as 100 times (the number of tickets issued at a particular excess speed) divided by (the total number of tickets issued).

[4] The kernel density estimate of the excess-speed distribution is calculated using Stata's kdensity command with a bandwidth of 0.75.

[5] "Excess Tickets Issued" is defined as the difference between the actual and estimated percentage of tickets issued at each mile per hour over the speed limit.

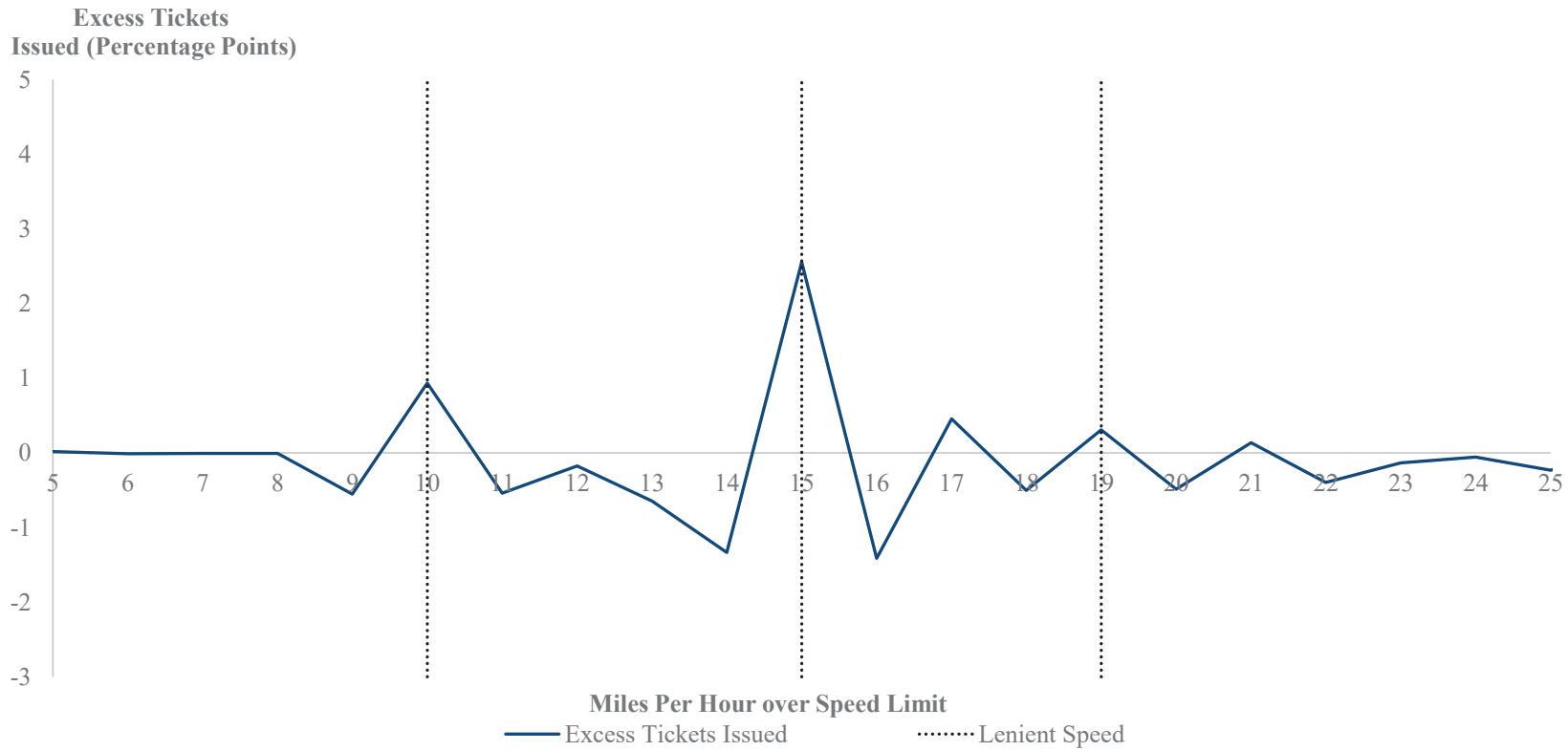
[6] Only tickets issued (actual and estimated) for speeds between 5 and 25 mph in excess of the limit are shown.

Sources:

[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.

[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

Exhibit 17B
Distribution of Excess Tickets Issued at Recorded Excess Speed on Speeding Tickets
All Drivers
Jan. 2010–Jun. 2017



Notes:

[1] This graph plots excess tickets, the difference between the actual and estimated percentage of tickets issued at each mile per hour over the speed limit. For example, at the excess speed of 10 mph over the speed limit, the actual percentage of tickets is one percentage point above the estimated percentage of tickets.

[2] Spikes in excess tickets are apparent at the lenient speeds of 10 mph and 15 mph over the speed limit.

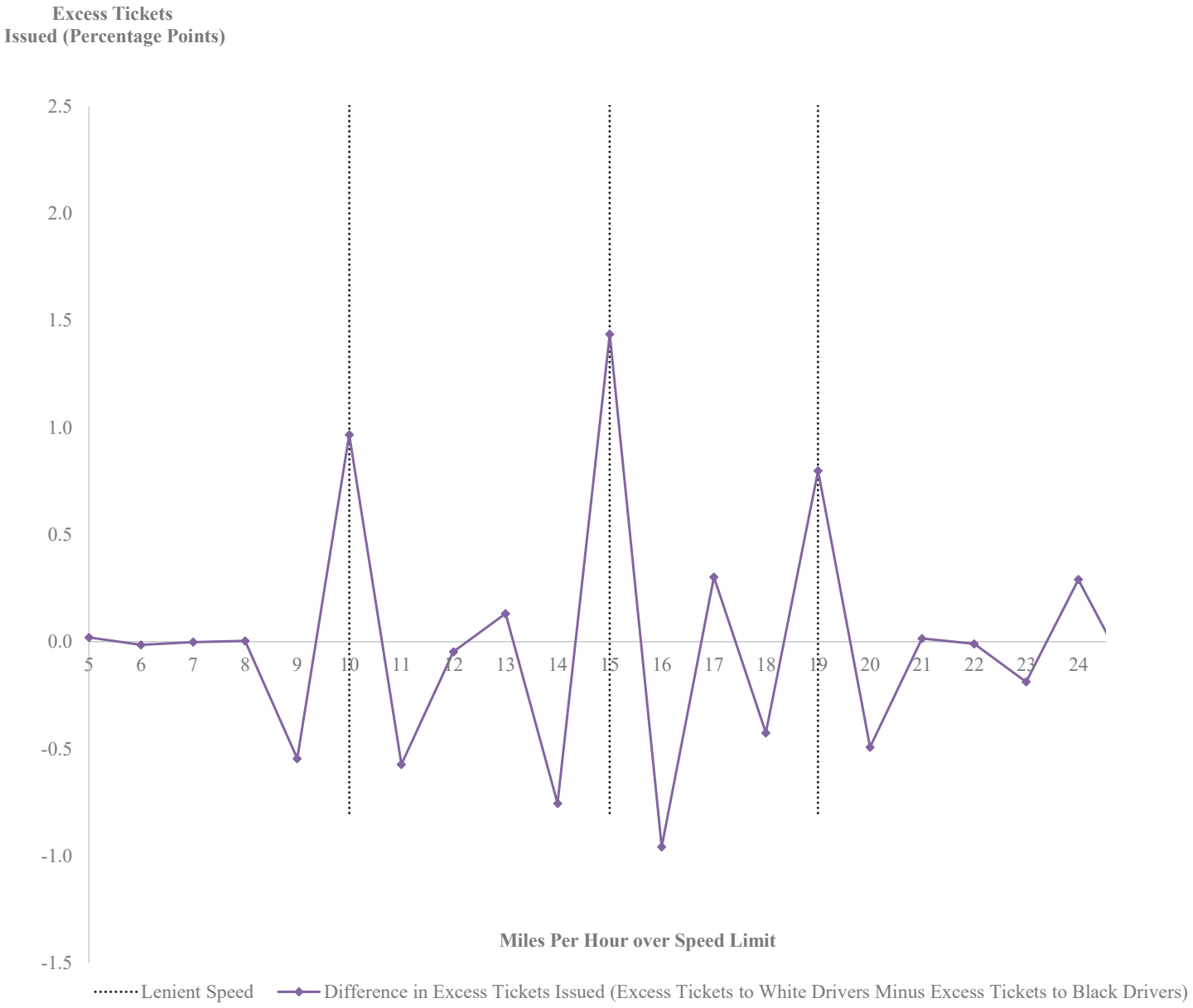
[3] Only tickets issued (actual and estimated) for speeds between 5 and 25 mph in excess of the limit are shown.

Sources:

[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.

[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

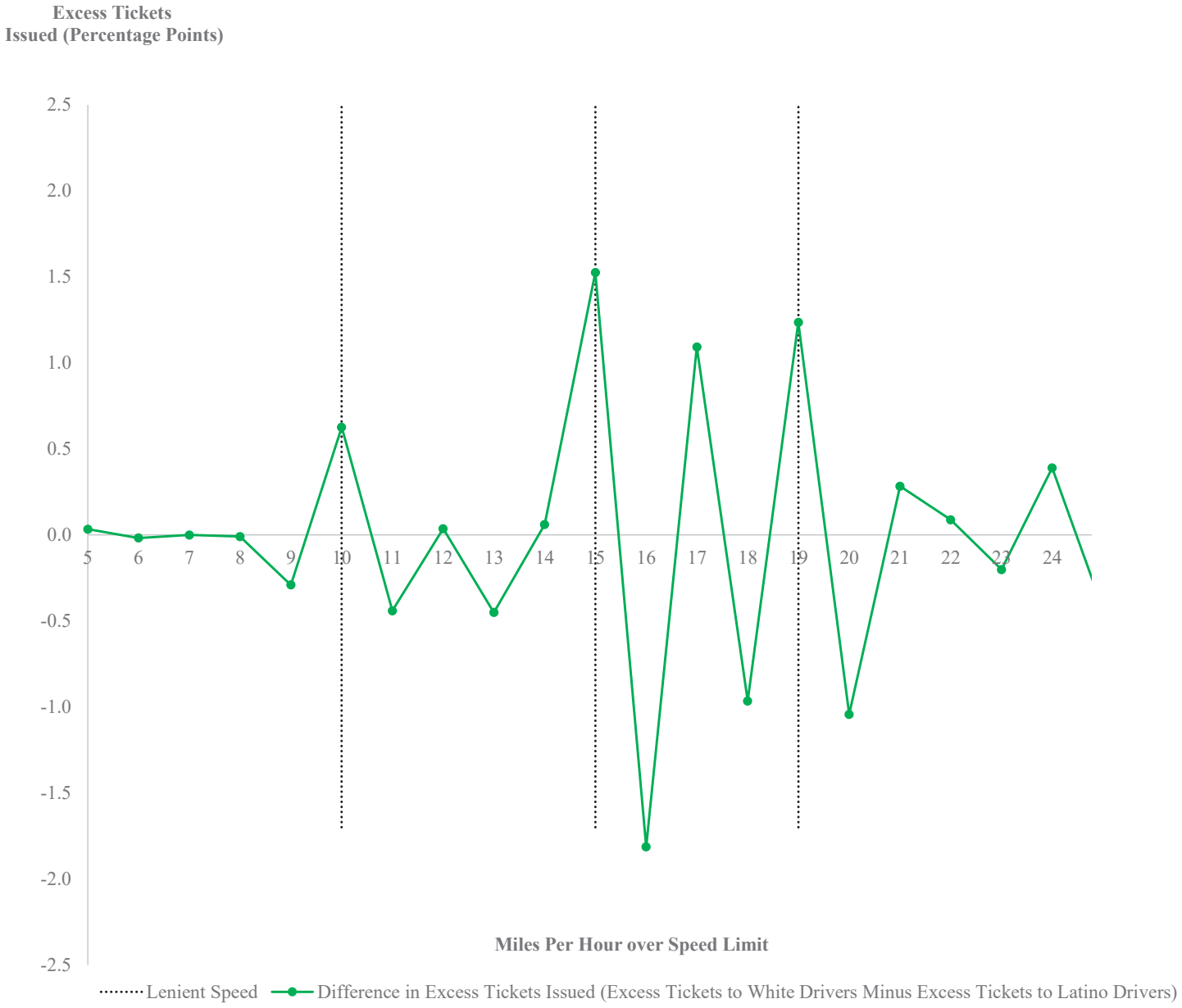
Exhibit 18A
Difference in Distribution of Excess Tickets Issued at Recorded Excess Speed on Speeding Tickets
White vs. Black Drivers
Jan. 2010–Jun. 2017



Notes:
[1] This graph shows the difference between excess tickets issued to white and Black drivers at each mile per hour over the speed limit. For example, white drivers were issued excess tickets of 1.62 percentage points at a speed of 10 mph over the speed limit, whereas Black drivers were issued excess tickets of 0.65 percentage points at this speed. The graph therefore plots the difference 1.62-0.65 = 0.97 percentage points at 10 mph over the speed limit.
[2] Positive spikes at 10, 15, and 19 mph over the speed limit indicate that tickets issued to white drivers are clustered more heavily at lenient speeds than tickets issued to Black drivers.
[3] This graph only shows excess tickets issued for speeds between 5 and 25 mph over the speed limit.

Sources:
[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.
[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

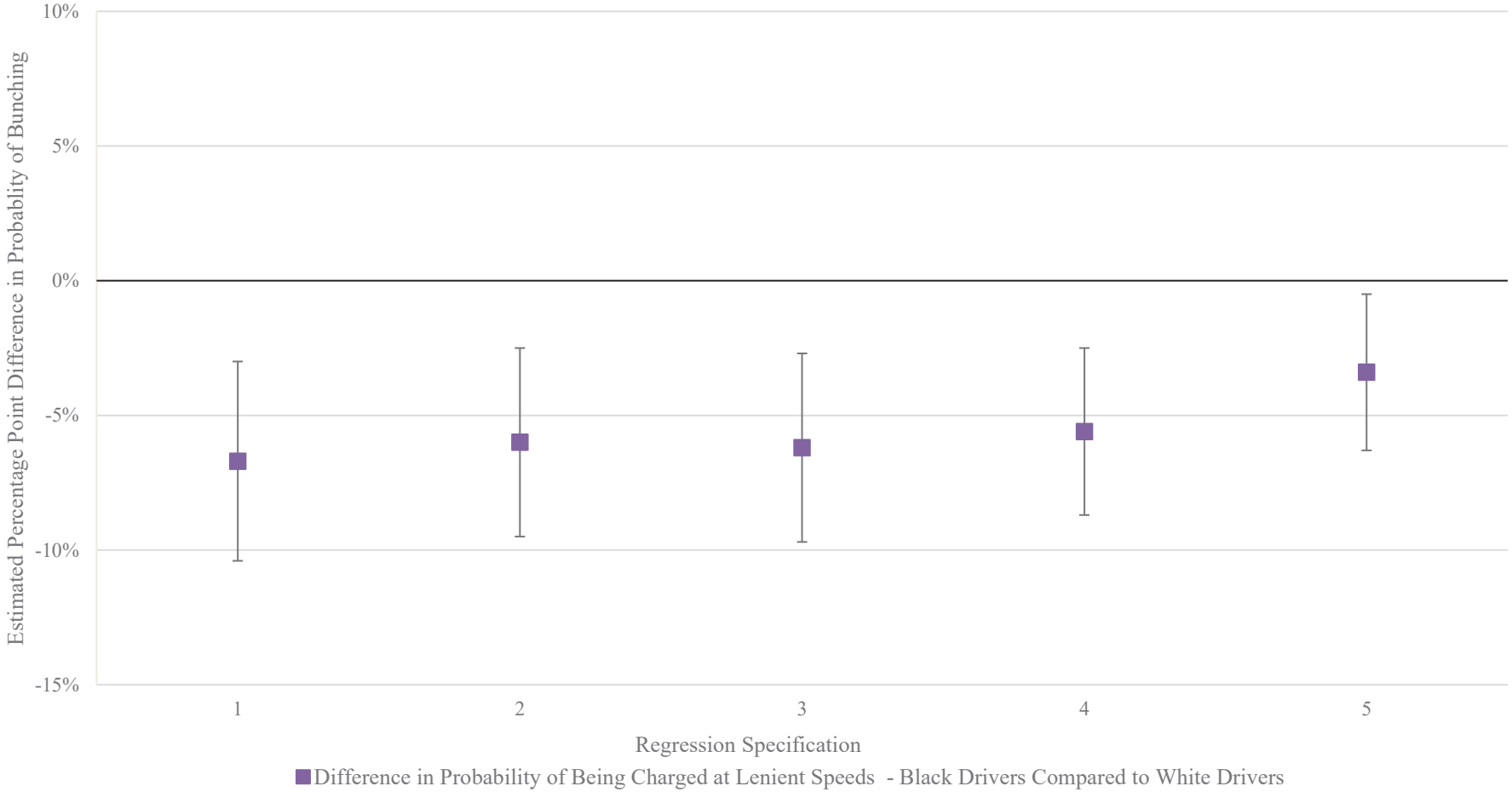
Exhibit 18B
Difference in Distribution of Excess Tickets Issued at Recorded Excess Speed on Speeding Tickets
White vs. Latino Drivers
Jan. 2010–Jun. 2017



Notes:
[1] This graph shows the difference between excess tickets issued to white and Latino drivers at each mile per hour over the speed limit. For example, white drivers were issued excess tickets of 1.62 percentage points at a speed of 10 mph over the speed limit, whereas Latino drivers were issued excess tickets of 0.99 percentage points at this speed. The graph therefore plots the difference 1.62-0.99 = 0.63 percentage points at 10 mph over the speed limit.
[2] Positive spikes at 10, 15, and 19 mph over the speed limit indicate that tickets issued to white drivers are clustered more heavily at lenient speeds than tickets issued to Latino drivers.
[3] This graph only shows excess tickets issued for speeds between 5 and 25 mph over the speed limit.

Sources:
[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.
[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

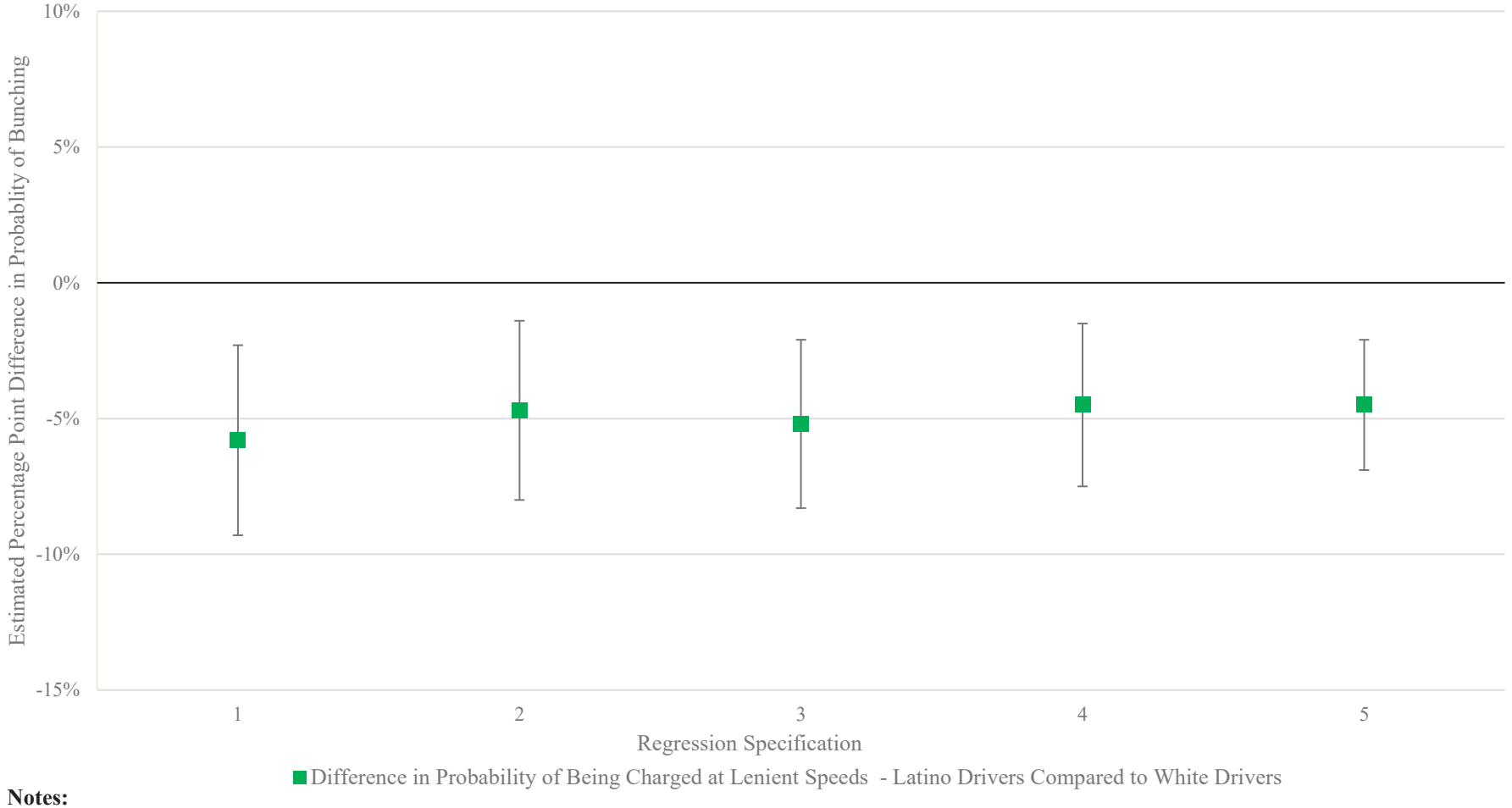
Exhibit 19A
Estimated Difference in Probability of Being Charged at Lenient Speeds for Black Drivers, As Compared to White Drivers
Jan. 2010–Jun. 2017



Notes:
[1] This graph shows the estimated difference in the probability that a ticket issued to a Black driver, as compared to a white driver, is for a lenient speed. The point estimate of this difference is plotted as a purple square, and the 95% confidence interval is represented by black whiskers.
[2] Estimates are presented for each regression specification discussed in the report text.
[3] Analysis is at the level of the individual speeding ticket. Standard errors are clustered using police officer badge numbers.

Sources:
[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.
[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

Exhibit 19B
Estimated Difference in Probability of Being Charged at Lenient Speeds for Latino Drivers, As Compared to White Drivers
Jan. 2010–Jun. 2017



Notes:
[1] This graph shows the estimated difference in the probability that a ticket issued to a Latino driver, as compared to a white driver, is for a lenient speed. The point estimate of this difference is plotted as a green square, and the 95% confidence interval is represented by black whiskers.
[2] Estimates are presented for each regression specification discussed in the report text.
[3] Analysis is at the level of the individual speeding ticket. Standard errors are clustered using police officer badge numbers.

Sources:
[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.
[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

Exhibit 20
Probability of Being Charged at Lenient Speed, by Race and Ethnicity
Jan. 2010–Jun. 2017

Probability that Issued Ticket Is for Lenient Speed		
Black	Latino	White
22.04%	22.89%	28.69%

Note:

[1] To calculate the probability that an issued ticket is for a lenient speed, the number of tickets issued at lenient speeds to drivers of a particular race is divided by the total number of tickets issued to drivers of that race.

Sources:

[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.

[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

Exhibit 21
Pedestrian Stops per 100 Residents by Race and District
2010 and 2013–2016

	District							
	1	2	3	4	5	6	7	Citywide
Pedestrian Stops per 100 Residents	2.8	2.8	2.7	2.9	3.4	1.2	2.1	2.4
Pedestrian Stops per 100 Black Residents	11.8	10.1	4.3	3.7	4.1	10.3	2.7	4.1
Pedestrian Stops per 100 White (including Latino) Residents	1.6	2.0	0.7	0.9	1.3	0.8	0.5	1.2

Ratio of Black Pedestrian Stop Rate to White (including Latino) Pedestrian Stop Rate
2010 and 2013–2016

	District							
	1	2	3	4	5	6	7	Citywide
Ratio of Black Stop Rate to White (including Latino) Stop Rate	7.2	4.9	6.1	4.2	3.2	13.2	5.4	3.5

Notes:

[1] The Black pedestrian stop rate in each district is the average of the Black pedestrian stop rates in each year 2010 and 2013–2016. The Black pedestrian stop rate in each district and year is calculated as the total number of pedestrian stops of Black people in that district and year, multiplied by 100, and divided by the number of Black residents of that district. The white (including Latino) pedestrian stop rate is calculated similarly.

[2] The overall pedestrian stop rate in each district is the average of the overall pedestrian stop rates in each year 2010 and 2013–2016. The overall pedestrian stop rate in each district and year is calculated as the total number of pedestrian stops of Black and white (including Latino) people in that district and year, multiplied by 100, and divided by the total number of Black and white (including Latino) residents of that district. This overall pedestrian stop rate omits people of "other" race/ethnicity from both the numerator and the denominator.

[3] The citywide Black, white (including Latino), and overall pedestrian stop rates are the average of the corresponding citywide pedestrian stop rates in each year 2010 and 2013–2016. The annual citywide pedestrian stop rates are calculated as the total number of pedestrian stops of people of the relevant race in that year, across all of Milwaukee, multiplied by 100, and divided by the total number of people of the relevant race in Milwaukee.

[4] The RMS data do not distinguish Hispanic or Latino residents into separate categories in the race field.

[5] "Pedestrian Stops per 100 Residents" is limited to stops of individuals with a recorded race of white (which includes Latino/Hispanic) or Black.

[6] The ratio of the Black stop rate to the white (including Latino) stop rate is calculated for each district as the number of pedestrian stops per 100 Black residents divided by the number of pedestrian stops per 100 white (including Latino) residents.

[7] Due to concerns about the completeness of the produced pedestrian stop data in 2011 and 2012, these years are omitted from this analysis.

Sources:

[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.

[2] U.S. Census, American Community Survey 5-Year Estimates, 2011–2015.

Exhibit 22
Pedestrian Stops per 100 Residents of the Same Race and Ethnicity
2010 and 2013–2016

	2010	2013	2014	2015	2016	Average
Black	6.1	4.9	4.2	2.6	2.8	4.1
White (including Latino)	1.5	1.3	1.5	0.7	0.8	1.2

Notes:

[1] Pedestrian stops per 100 Black residents in 2013 is calculated as the total number of pedestrian stops of Black residents in Milwaukee in 2013, multiplied by 100, and divided by the total number of Black residents in Milwaukee. Similar calculations are performed for white (including Latino) residents and in other years.

[2] The RMS data do not distinguish Hispanic or Latino residents into separate categories in the race field.

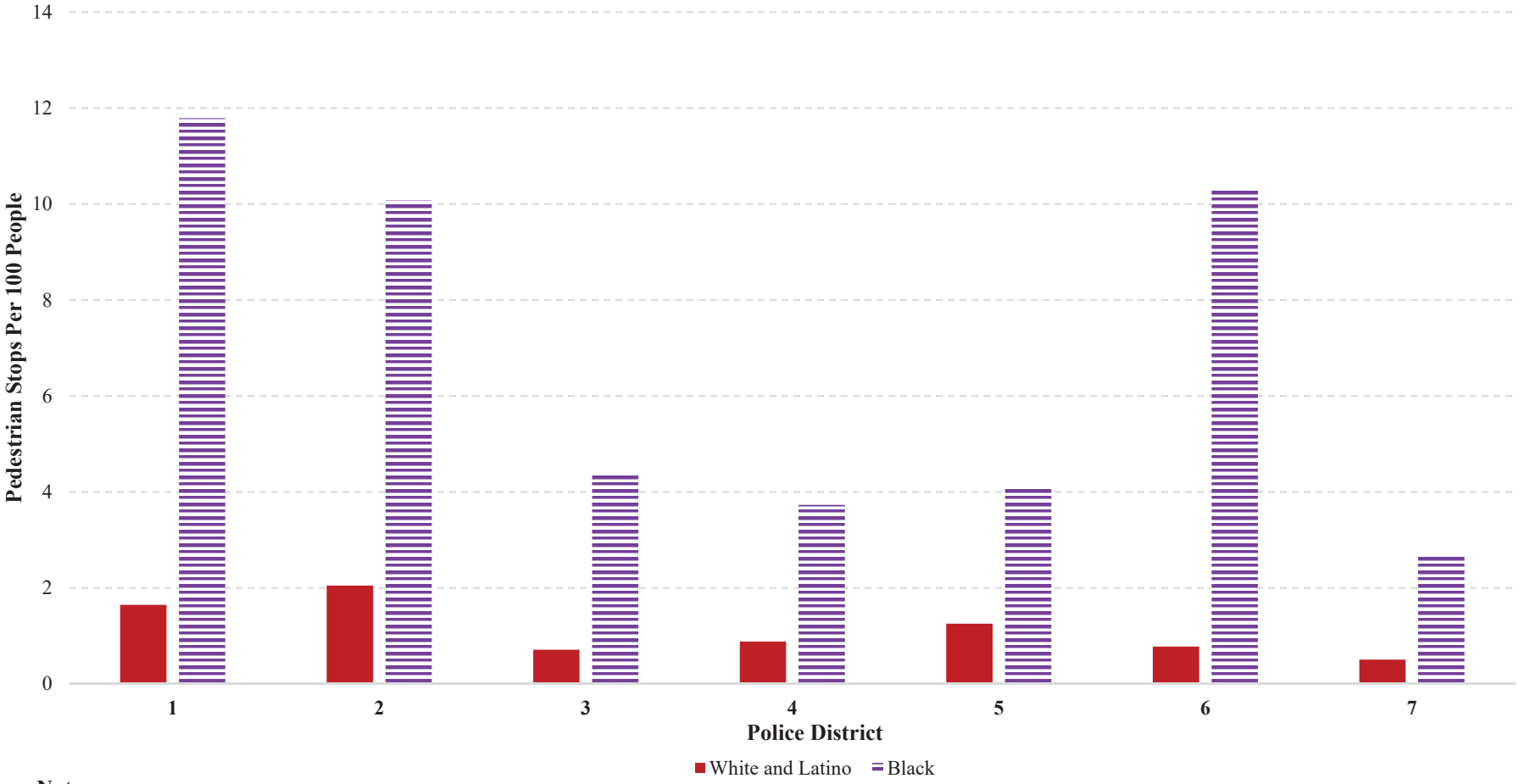
[3] Due to concerns about the completeness of the produced pedestrian stop data in 2011 and 2012, these years are omitted from this analysis.

Sources:

[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.

[2] U.S. Census, American Community Survey 5-Year Estimates, 2011–2015.

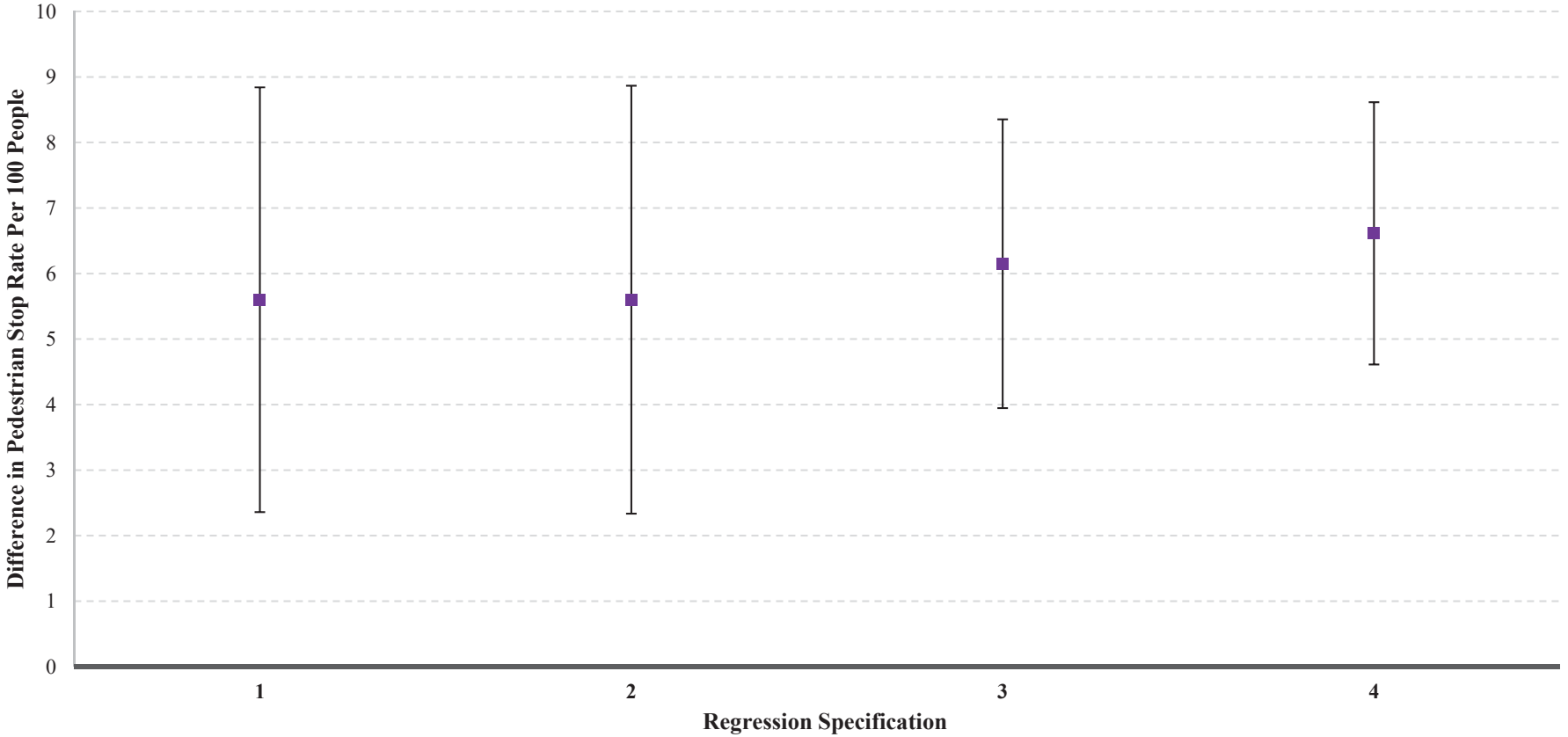
Exhibit 23
Pedestrian Stop Rates by Race and District
2010 and 2013–2016



Note:
[1] This graph shows the pedestrian stop rate per 100 people, by race, in each MPD district.
[2] Due to concerns about the quality of the produced pedestrian stop data in 2011 and 2012, these years are omitted from this analysis.

Sources:
[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.
[2] Demographic and mapping data, as discussed in the report text and Appendix C.

Exhibit 24
Estimated Difference in Pedestrian Stop Rate for Black People, as Compared to White (Including Latino) People
2010 and 2013–2016



Notes:

[1] This graph shows the estimated difference in the rate at which Black people, as compared to white (including Latino) people, are subjected to pedestrian stops (purple square) and the ninety-five percent confidence interval for this estimate (black whiskers).

[2] Estimates are presented for each of the regression specifications discussed in the report text.

[3] Pedestrian stop rates are per hundred people. An estimated difference of 5, for example, implies that the pedestrian stop rate is higher for Black people than white (including Latino) people by 5 stops per 100 people.

[4] Due to concerns about the completeness of the produced pedestrian stop data in 2011 and 2012, these years are omitted from this analysis.

Sources:

[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.

[2] Demographic, crime, and mapping data, as discussed in the report text and Appendix C.

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EMPLOYMENT

University of Pennsylvania Law School, Philadelphia, Pennsylvania
Professor of Law, July 2013 - present
Assistant Professor of Law, July 2008 – present

The Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania
Professor of Business Economics & Public Policy (secondary), July 2013 - present
Assistant Professor of Business Economics & Public Policy (secondary), July 2008 - present
Senior Fellow, Leonard Davis Institute of Health Economics, 2012 – present
Faculty Affiliate, LDI Center for Health Incentives, 2009 - present

The University of Chicago Law School, Chicago, Illinois
John M. Olin Fellow in Law and Economics & Lecturer in Law, July 2006 – June 2008
- 2007 Ronald H. Coase Prize for Outstanding Paper in Law and Economics

D. E. Shaw and Co., New York, New York
Quantitative Analyst and Trader, Convertible Arbitrage Strategy, July 1998 – August 1999

EDUCATION

Massachusetts Institute of Technology, Cambridge, Massachusetts
Ph.D., Economics, June 2006
- Thesis: "Essays on the Economics of Law, Crime, and Discrimination"
- Advisors: Michael Greenstone, Sendhil Mullainathan

Stanford University, Stanford, California
M.S., Physics, January 2001
- Research in particle astrophysics

Harvard University, Cambridge, Massachusetts
A.B., Physics, *magna cum laude*, June 1998
- Harvard College Scholarship
- Robert Byrd Scholarship
- National Plasma Fusion Fellowship

RECENT PUBLICATIONS

David S. Abrams, *The Law and Economics of Stop-and-Frisk*, 46 LOYOLA LAW REVIEW 369

David S. Abrams, *How Do We Decide How Long to Incarcerate?*, *in* EMPIRICAL LEGAL ANALYSIS: ASSESSING THE PERFORMANCE OF LEGAL INSTITUTIONS (Yun-chien Chang, ed., 2014)

David S. Abrams & R. Polk Wagner, *Poisoning the Next Apple? How the America Invents Act Harms Inventors*, 65 STANFORD LAW REVIEW 517 (2013).

David S. Abrams, *The Imprisoner's Dilemma: A Cost-Benefit Approach to Incarceration,* 98 IOWA LAW REVIEW 905 (2013).

David S. Abrams, *Putting the Trial Penalty on Trial,* 51 DUQUESNE LAW REVIEW 777 (2013).

David S. Abrams & Daniel L. Chen, *A Market for Justice: A First Empirical Look at Third Party Litigation Funding*, 15 JOURNAL OF BUSINESS LAW 1075 (2013).

David S. Abrams, *Estimating the Deterrent Effect of Incarceration Using Sentencing Enhancements*, 4 AEJ: APPLIED ECONOMICS 32 (2012)

David S. Abrams, Marianne Bertrand, & Sendhil Mullainathan, *Do Judges Vary in Their Treatment of Race?*, 41 JOURNAL OF LEGAL STUDIES 347 (2012).

David S. Abrams, *Is Pleading Really a Bargain?*, 8 JOURNAL OF EMPIRICAL LEGAL STUDIES 200 (2011).

David S. Abrams & Chris Rohlfs, *Optimal Bail and the Value of Freedom: Evidence from the Philadelphia Bail Experiment*, 49 ECONOMIC INQUIRY 750 (2011).

David S. Abrams, *Did TRIPS Spur Innovation? An Analysis of Patent Duration and Incentives to Innovate*, 157 UNIVERSITY OF PENNSYLVANIA LAW REVIEW 1613 (2009).

David S. Abrams & Albert H. Yoon, *The Luck of the Draw: Using Random Case Assignment to Investigate Attorney Ability*, 74 UNIVERSITY OF CHICAGO LAW REVIEW 1145 (2007). (winner of the 2007 Ronald H. Coase Prize)

WORKING PAPERS

David S. Abrams, Ufuk Akcigit & Gokhan Oz, *The NPE: Benevolent Middleman or Stick-Up Artist?* (working paper)

David S. Abrams, Ufguk Akcigit & Jillian Popadak, *Patent Value and Citations: Creative Destruction or Strategic Disruption,* (Penn Inst. for Econ. Res., Working Paper 13-065, 2013).

David S. Abrams, *Building Criminal Capital vs. Specific Deterrence: The Effect of Incarceration Length on Recidivism* (revise and resubmit).

David S. Abrams & L. Strahilevitz, *Do More Eyes on the Road Mean Better Driving?* (Working Paper).

WORK IN PROGRESS

"Outside Directors as a Brake on Corporate Control Transactions" (with M. Kahan and E. Rock)

"Learning about Real Economics in Virtual Worlds"

"Patent Duration and Innovation in the Pharmaceutical Industry"

"Multitasking in the Multiverse: Field Evidence from a Virtual World" (with A. Cohn, E. Fehr, A. Nicklisch)

"Understanding High Skill Worker Productivity using Random Case Assignment in a Public Defender's Office" (with A. Yoon)

"When Docs Snooze Do You Lose? Medical Resident Work Hours and Patient Outcomes"

OTHER PUBLICATIONS

David S. Abrams et al., *Present Status of the Cryogenic Dark Matter Search (CDMS II) Experiment*, 329 PHYSICA B: CONDENSED MATTER 1590 (2003).

D. Abrams et al., *Exclusion Limits on the WIMP-nuclear Cross Section from the Cryogenic Dark Matter Search*, 66 PHYSICAL REV. D 122003-1 (2002).

T. Saab et al., *Deployment of the First CDMS II ZIP Detectors at the Stanford Underground Facility*, 110 NUCLEAR PHYSICS B – PROC. SUPPLEMENTS 100 (2002).

PRESENTATIONS

2015:

American Law and Economics Association (New York)
University of Chicago Law and Economics Colloquium
Works in Progress in Intellectual Property (Washington DC)
Fifth Annual Tri-State Region IP Workshop (New York)

2014:

NYU Intellectual Property Colloquium
Conference on Empirical Legal Studies (Berkeley)
Rutgers-Camden Law School Colloquium
University of Houston Law School Colloquium
Roundtable on Empirical Methods in Intellectual Property (Chicago)
Conference on Value Pluralism and Intellectual Property Law (Hong Kong)
American Law and Economics Association (Chicago)
Loyola Law Review Symposium (Chicago)
Texas Law Review Symposium
Fourth Annual Tri-State Region IP Workshop (New York)

2013:

Hebrew University
Patent Reform Conference (Philadelphia)
ETH Zurich
University of Oslo
Patent Statistics for Decision Makers

IP Scholars Conference (New York)
NBER Summer Institute Industrial Organization Workshop
NBER Summer Institute IP and Innovation Workshop
American Law and Economics Association Conference (Nashville)
Understanding Entrepreneurship Conference (Israel)
Stanford Design Patents Conference
Patent Conference 3 (Chicago)
Duquesne Law School Symposium: Plea Bargaining After *Lafler* and *Frye*
Works in Progress Intellectual Property Conference (Newark, NJ)
University of Virginia, Batten School Faculty Research Series

2012:

Hunter Economics Colloquium (New York)
Conference on Empirical Legal Studies (Stanford)
Harvard Law and Economics Workshop
U Chicago Workshop on Judicial Behavior
Empirical Patent Law Conference (Ithaca)
Wharton Applied Economics Workshop
National Law University, Jodhpur (India)
National Law School India University, Bangalore (India)
Copenhagen Business School
Conference on Crime Control Policy (Paris)
American Law and Economics Association Conference
Santa Clara International IP Symposium
Fordham Tri-State IP Conference

2011:

Conference on Empirical Legal Studies (Chicago)
U Texas Law and Economics Colloquium
Third-Party Financing of Litigation Conference (New York)
Workshop on Innovation and Patent Harmonization (Boston)
Intellectual Property Scholars Conference
Petroleum University (Beijing)
International Empirical Legal Studies Conference (Taipei)
Workshop on the Law and Economics of IP and Competition Law (Munich)
American Law and Economics Association Conference
Columbia Applied Microeconomics Seminar
Berkeley Law and Economics Workshop
Harvard Law, Economics, and Organization Seminar

2010:

Northwestern Law and Economics Workshop
U Michigan Law and Economics Workshop
Conference on Empirical Legal Studies (New Haven)
Georgetown Law and Economics Workshop
Cornell Judgment by the Numbers Conference

NBER Summer Institute Economics of Crime Workshop
RAND Alternative Litigation Finance Academic Roundtable
U Chicago Conference on the Law and Economics of Race
U Texas Law and Economics Colloquium
U Virginia Law and Economics of Criminal Law Conference (commentator)
U Penn Health Services Research Seminar
U Penn Annenberg School Colloquium
Temple Law & Behavior Colloquium
American Economic Association Annual Meeting

2009:

Association for Public Policy Analysis and Management Conference
U Penn Empirical Research in Law Conference
Works in Progress Intellectual Property Conference
Intellectual Property Scholars Conference
NBER Summer Institute Personnel Economics Workshop
NBER Summer Institute L&E Workshop
Hebrew University Crime Workshop
Bar-Ilan University Law School Colloquium
Rutgers Economics Colloquium
University of Virginia Law and Economics Workshop
George Mason Public Choice Seminar
Junior International Law Scholars Conference
U Penn Symposium on the Foundations of Intellectual Property Reform

2008:

Conference on Empirical Legal Studies
Econometric Society Australasian Meeting
American Law and Economics Association Conference
University of Chicago Graduate School of Business
Harvard Law, Economics, and Organizations Seminar
George Mason Law School
Duke University Law School

2007:

University of Pennsylvania Law School
Washington University Law School
University of Texas Law School
Association for Public Policy Analysis and Management Conference
Conference on Empirical Legal Studies
University of Pennsylvania, Wharton School
Northwestern University, School of Law
NBER Crime Working Group Meeting
American Law and Economics Association Conference
Criminology and Economics Summer Workshop
European University Institute
University of Chicago Law School
University of Chicago Graduate School of Business

University of Zurich

2006:

Conference on Empirical Legal Studies
Criminology and Economics Summer Workshop
Harvard Law, Economics, and Organizations Seminar
Harvard Law and Economics Seminar

2005:

MIT Labor Economics Seminar
NBER Summer Institute (Law and Economics Workshop)

TEACHING

Advanced Topics in Intellectual Property
University of Pennsylvania – Fall 2014

Analytical Methods in Law
University of Chicago – Fall 2006, Spring 2008
University of Pennsylvania – Fall 2008, Fall 2009, Fall 2010, Fall 2012, Spring 2015

Introduction to Intellectual Property
University of Pennsylvania – Spring 2010, Spring 2011, Spring 2012, Spring 2013

Introduction to Law and Economics
University of Pennsylvania – Spring 2014, Spring 2015

Law and Economics Seminar
University of Pennsylvania – Fall 2008, Fall 2009, Fall 2010, Spring 2014

Law, Economics and Psychology Seminar
University of Pennsylvania – Fall 2012

PROFESSIONAL ACTIVITIES

Chair, American Association of Law Schools Law & Economics Section, 2015 - present

Faculty Advisory Committee, Quattrone Center for the Fair Administration of Justice, 2013 - present

Vice-chair, American Association of Law Schools Law & Economics Section, 2014 - 2015

President, Society for Empirical Legal Studies, 2012-2013

Faculty Affiliate, University of Chicago Crime Lab, 2009 - present

Member: American Economic Association, American Law and Economics Association, American Physical Society, Econometric Society

Referee: American Economic Review, American Law and Economics Review, American Economics Journal: Applied Economics, Economic Journal, Journal of Empirical Legal

Studies, Journal of Human Resources, Journal of Law and Economics, Journal of Legal Analysis, Journal of Legal Studies, Journal of Political Economy, Journal of Public Economics, Quarterly Journal of Economics, RAND Journal of Economics, Review of Economics and Statistics, Review of Economic Studies

Appendix B
Materials Relied Upon

Litigation Documents

1. Amended Class Action Complaint for Declaratory and Injunctive Relief, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. May 24, 2017), ECF No. 19.
2. Plaintiffs' First Set of Requests for Production of Documents and Things to Defendants, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. April 6, 2017).
3. Report of Margo Frasier, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. Feb. 20, 2018).

Data

Produced by Defendants

4. Codes - Status.csv (produced by Defendants) (MKE_0066947).
5. Codes - TSContraband.csv (produced by Defendants) (MKE_0066948).
6. Codes - TSOutcome.csv (produced by Defendants) (MKE_0066949).
7. Codes - TSReason.csv (produced by Defendants) (MKE_0066950).
8. Codes - TSReasonDetail.csv (produced by Defendants) (MKE_0066951).
9. Codes - TSSearchBasis.csv (produced by Defendants) (MKE_0066952).
10. CodeTables.xlsx (produced by Defendants) (MKE_0013181).
11. Contraband.csv (produced by Defendants) (MKE_0066953).
12. FieldInterview-ConsentSearch-Contraband2013-2015.xlsx (produced by Defendants) (MKE_0601169).
13. FieldInterview-ConsentSearch-Contraband2016-9.19.2017.xlsx (produced by Defendants) (MKE_0601170).
14. Outcome.csv (produced by Defendants) (MKE_0066958).
15. ReasonContact.csv (produced by Defendants) (MKE_0066960).
16. ReasonDetail.csv (produced by Defendants) (MKE_0066961).
17. RMS_INCIDENTS_RELATED_TO_CALLS_FOR_SERVICE_FI_PERSON_pipe.txt (produced by Defendants) (MKE_0096271).
18. RMS_INCIDENTS_RELATED_TO_CALLS_FOR_SERVICE_FI_VEHICLE_pipe.txt (produced by Defendants) (MKE_0096272).
19. RMS_INCIDENTS_RELATED_TO_CALLS_FOR_SERVICE_PERSONS (produced by Defendants) (MKE_0013312).
20. RMS_INCIDENTS_RELATED_TO_CALLS_FOR_SERVICE_VEHICLE (produced by Defendants) (C0000011).
21. RMS_NARRATIVES_TRAFFIC_STOP_2008_to_10_7_2016_PIPE.txt (produced by Defendants) (MKE_0609290).
22. SearchBasis.csv (produced by Defendants) (MKE_0066967).
23. Status.csv (produced by Defendants) (MKE_0066968).
24. T10_CitizenContact_All_pipe.csv (produced by Defendants) (MKE_0096273).

25. T10_Contact Summary_2016_pipe.csv (produced by Defendants) (MKE_0013316).
26. T10_Contact Summary_2017_pipe.csv (produced by Defendants) (MKE_0013317).
27. T10_ContactSummary_2014_through_2015_pipe.csv (produced by Defendants) (MKE_0013315).
28. T10_ContactSummary_Individuals_All_pipe.csv (produced by Defendants) (MKE_0066969).
29. T10_ELCI_2014_through_2015_pipe (produced by Defendants) (MKE_0013319).
30. T10_ELCI_2016_through_2017_pipe (produced by Defendants) (MKE_0013320).
31. T10_NTC_2014_through_2015_pipe (produced by Defendants) (MKE_0013321).
32. T10_NTC_2016_through_2017_pipe (produced by Defendants) (MKE_0013322).
33. T7_CitizenContact_All_pipe.csv (produced by Defendants) (MKE_0096274).
34. T7_ELCI_2008_through_2012_pipe.csv (produced by Defendants) (MKE_0066973).
35. T7_ELCI_2013_through_2017_pipe.csv (produced by Defendants) (MKE_0066974).
36. T7_NTC_2008_through_2012_pipe.csv (produced by Defendants) (MKE_0066975).
37. T7_NTC_2013_through_2017_pipe.csv (produced by Defendants) (MKE_0066976).
38. T7_TrafficStop_2008_through_2011_pipe (produced by Defendants) (MKE_0013332).
39. T7_TrafficStop_2012_through_2014_pipe (produced by Defendants) (MKE_0013333).
40. T7_TrafficStop_2015_through_2017_pipe.xlsx (produced by Defendants) (C0000022).

Disclosed by Wisconsin Department of Transportation

41. Letter from Daniel A. Graff, Assistant General Counsel, Wis. Dep't of Transp. to Larry Dupuis, Legal Director, ACLU of Wis. (July 28, 2017) (electronic media titled "Driver.txt").
42. Letter from Larry Dupuis, Legal Director, ACLU of Wis. to Kristina Boardman, Wis. Dep't of Transp. (May 19, 2017).

Publicly Available

43. *Wisconsin Incident Based Report (WIBR) Group A Offenses*, CITY OF MILWAUKEE, http://itmdapps.milwaukee.gov/publicApplication_QD/queryDownload/login.faces (last visited Jan. 31, 2018).
44. *Map Milwaukee Portal, Police Districts*, CITY OF MILWAUKEE (July 2009), http://city.milwaukee.gov/DownloadMapData3497.htm#.WiBcSoWcESt.
45. *2008-2015 American Community Survey 1-Year Estimates: Total Population – Milwaukee city, Wisconsin*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).
46. *2011-2015 American Community Survey 5-Year Estimates: Hispanic or Latino Origin By Race (B03002)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).
47. *2011-2015 American Community Survey 5-Year Estimates: Selected Economic Characteristics*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).

48. *2011-2015 American Community Survey 5-Year Estimates: Sex by Age: Black or African American Alone (B01001B)*, *Sex by Age: Hispanic or Latino (B01001I)*, and *Sex by Age: White Alone, Not Hispanic or Latino (B01001H)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018).

49. *2011-2015 American Community Survey 5-Year Estimates:Place of Birth for the Foreign-Born Population of the United States (B05006)*, U.S. CENSUS BUREAU, https://factfinder.census.gov (last visited Jan. 21, 2018).

50. *2015 Gazetteer Files - Wisconsin*, U.S. CENSUS BUREAU, https://www2.census.gov/geo/docs/maps-data/data/gazetteer/2015_Gazetteer/2015_gaz_place_55.txt (last visited Jan. 31, 2018).

51. *2016 American Community Survey 1-Year Estimates: Hispanic or Latino Origin By Race (Table B03002)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Feb. 7, 2018).

52. *2016 American Community Survey 1-Year Estimates: Hispanic or Latino Origin By Specific Origin (B03001)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Feb. 2, 2018).

53. *2015 TIGER/Line Shapefiles: Census Tracts - Wisconsin*, U.S. CENSUS BUREAU (Aug. 19, 2015), https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2015&layergroup=Census+Tracts.

54. *HUD USPS Zip Code Crosswalk Files*, U.S. DEP'T OF HOUSING AND URB. DEV., https://www.huduser.gov/portal/datasets/usps_crosswalk.html#data (last visited Jan. 31, 2018).

55. U.S. Dep't of Justice - Federal Bureau of Investigation, *Table 78, Wisconsin: Full-time Law Enforcement Employees by State by City*, 2008 CRIME IN THE UNITED STATES (Sep. 2009), https://www2.fbi.gov/ucr/cius2008/data/documents/08tbl78wi.xls.

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Appendix C
Construction of Variables Used for Analysis

1. This Appendix provides an overview of the data used to construct variables that are part of the empirical analyses contained in this report. The data used includes that produced by the Defendants in *Collins v. City of Milwaukee*, No. 2:17-cv-00234-JPS (E.D. Wis.), as well as from the U.S. Census American Community Survey and the Wisconsin Department of Transportation.

I. DATA PRODUCED BY THE DEFENDANTS

A. The Traffic and Criminal Software Traffic and Pedestrian Stop Data

2. The Milwaukee Police Department ("MPD") collects information on traffic stops, pedestrian stops, and consensual encounters known as "citizen contacts" using the Traffic and Criminal Software ("TraCS"), which is administered by the State of Wisconsin.[1] In response to Plaintiffs' request for production of data on all MPD traffic stops, pedestrian stops, and frisks conducted since January 1, 2008, the Defendants produced, among other data, data on police encounters from January 2008 through April 2017 from the T7 version of TraCS and data on police encounters from 2014 through June 2017 from the T10 version of TraCS. As discussed further below, some of this data is incomplete or of questionable reliability. I used a subset of the T7 TraCS data as the basis for my analyses of traffic stops in this report.

3. Traffic stops involve the temporary detention of a driver, and potentially any passengers in a vehicle, by a police officer to investigate a crime or issue warnings or citations for the

[1] Letter from Joseph M. Russell, von Briesen & Roper, s.c. to Nusrat J. Choudhury & Jason D. Williamson, ACLU Foundation, Inc., Karyn Rotker & Laurence J. Dupuis, ACLU of Wisconsin Foundation and Shanya Dingle, Covington & Burling LLP 2 (July 5, 2017) [hereinafter "Russell Letter, July 5, 2017") (identifying TraCS as "the data collection, records management, and reporting software the MPD uses to record, retrieve, and manage" information concerning Wisconsin Uniform Traffic Citations and "traffic stops and citizen contacts); id. at 6 (confirming that TraCS data produced by Defendants includes data on pedestrian stops).

violation of traffic or non-traffic laws. Similarly, pedestrian stops involve the temporary detention of a person on foot by a police officer to investigate a crime or issue warnings or citations for a criminal offense or ordinance violation.

4. T7 TraCS collected information from T7 forms completed by police officers during traffic stops.[2] The data includes stops that resulted in a warning, traffic citation, or non-traffic citation, as well as stops that did not result in any of those outcomes.[3] T7 TraCS was in use by January 1, 2008,[4] but traffic stop data do not appear in the T7 production before November 2010. In 2013, the MPD began a gradual transition to an updated version of TraCS known as T10.[5] Data from T10 "Contact Summary" forms, filled out by police officers in the course of conducting traffic or pedestrian stops, is entered into the T10 TraCS system.[6]

5. In both the T7 and T10 TraCS data, each observation represents a single traffic stop, pedestrian stop, electronic citation, non-traffic citation, warning, or citizen contact. For my analysis of traffic stops and traffic stop outcomes, I consider the T7 TraCS data produced in files beginning "T7_TrafficStops" and T10 TraCS data produced in files beginning "T10_ContactSummary." I limit this data to observations of traffic stops.[7] Throughout this

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2 *Id*. at 3.

3 *Id*. at 2–3; *see also* Memorandum from Regina Howard, Captain, Office of Mgmt., Analysis and Planning ("OMAP") to All Dep't Members (Nov. 25, 2013) (produced by Defendants) (MKE_0006835) (instructing "All Department Members" of the MPD to "Continue Using TraCS for Data Collection" despite the State legislature's repeal of a requirement to do so); id. ("All traffic stops are required to have a traffic stop data form completed as per the directive.").

4 Letter from Joseph M. Russell, von Briesen & Roper, s.c. to Shanya Dingle, Covington & Burling LLP (May 15, 2017) [hereinafter "Russell Letter, May 15, 2017"].

5 Russell Letter, July 5, 2017, *supra* note 1, at 2.

6 Russell Letter, July 5, 2017, *supra* note 1, at 4.

7 In the T7 TraCS data, I limit the data to observations where the "Reason" field includes "Traffic Stop" as a value. Other values that the "Reason" field may take on include "Citizen Assist/Welfare Check," "Criminal Offense," "Crash Investigation," "Dispatched Assignment," "Field Interview Stop," and "Other." *See* Codes - TSReason.csv (produced by Defendants) (MKE_0066950). In the T10 TraCS data, I limit the data to observations where the field "summaryReason" includes "Traffic Stop" as a value. Other values that the "summaryReason" field may take on include "Field Interview," "Dispatched Assignment," "Crash

report, I refer to the traffic stop data in the files beginning "T7_TrafficStops" and "T10_ContactSummary" as "T7 TraCS traffic stop data" and "T10 TraCS traffic stop data," respectively.

6. The total number of traffic stops documented in the T7 and T10 TraCS data produced by Defendants is summarized in **Exhibit C-1**. The same information is presented in terms of the share of total traffic stops recorded by each version of TraCS in **Exhibit C-2**. As **Exhibit C-2** demonstrates, the vast majority of data on 2015 traffic stops produced by Defendants (84 percent) was from the T7 version of TraCS, while 80 percent of the 2016 traffic stop data produced was from T10 TraCS.

7. When filling out data in either the T7 or T10 version of TraCS, MPD officers record the race of an individual in a race field with a predefined "picklist."[8] Based on a tabulation of the TraCS data, this picklist included the following race categories: "Asian," "Black," "Hispanic," "Indian," and "White." Given the predefined nature of the race field, it is not possible to disentangle the race of an individual recorded in the data from that individual's Hispanic or Latino ethnicity. In other words, it is not clear how MPD officers classified Black people of Hispanic or Latino ethnicity, white people of Hispanic or Latino ethnicity, Asian people of Hispanic or Latino ethnicity, etc.

8. Furthermore, a substantial proportion of traffic stops in the T10 data produced by Defendants is missing basic demographic information about the subject of the stop, as indicated in **Exhibit C-3**. In particular, about one-third to one-half of the traffic stops documented in the T10 data from 2015 through 2017 are missing demographic information about the subject of the stop, whereas none of the traffic stops documented in the T7 TraCS data over the years 2011 through 2017 are missing demographic information. Where demographic information is

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Investigation," "Citizen Assist/Welfare Check," and "Criminal Offense." *See* ReasonContact.csv, (produced by Defendants) (MKE_0066960).

[8] *See* WISDOT, BADGER TRACS: USER GUIDE 113 (Mar. 2008) (T7 version of TraCS);. WISDOT, BADGER TRACS: USER GUIDE 309 (Apr. 25, 2017) (indicating that "defendantRace" is set to "A, B, H, I, [or] W" in the T10 version of TraCS).

available in the T10 TraCS data, moreover, inconsistencies with the T7 TraCS data raise further questions about the reliability and representativeness of the T10 TraCS data. As indicated in **Exhibit C-4**, during 2015 and 2016—the two years in which both versions of the TraCS software were in use by the MPD—the T10 TraCS data with complete demographic information contains disproportionately fewer traffic stops for Black drivers than the T7 TraCS data. Absent a reason to expect that officers using the T10 system would, as a group, stop Black drivers at a lower rate than officers using the T7 system, the data suggests that the missing demographic information in the T10 TraCS is not random with respect to race. In other words, the one-third to one-half of T10 TraCS traffic stops with missing demographic information in these years are likely to contain disproportionately more stops of Black drivers. Altogether, I conclude that the T10 TraCS data is unreliable because 36 to 47 percent of the traffic stop data is missing demographic information each year, whereas *all* T7 TraCS traffic stop data includes such information; and of the T10 TraCS traffic stop data with complete demographic information, there are disproportionately fewer traffic stops of Black drivers than in the T7 TraCS data recorded during the same time period.

9. Given the resulting concerns about the reliability and representativeness of the produced T10 TraCS data, traffic stops recorded using this version of the TraCS software are excluded from the analyses presented in the report. The traffic stop data used in my analyses is therefore limited to (i) those traffic stops recorded in the T7 TraCS data and (ii) the years in which traffic stops were predominantly recorded in the T7 version of TraCS. These criteria limit the traffic stop analysis to 2011 through 2015.[9]

10. The T7 TraCS system records whether a search was conducted during a traffic stop and whether that search resulted in the discovery of contraband. The data includes separate fields "driversearchconducted" and "vehiclesearchconducted," as well as fields documenting the discovery of contraband through either type of search, "drivercontraband" and

[9] I reserve the right to update my analyses to include the T10 TraCS data or other relevant data should additional data be produced by the Defendants.

"vehiclecontraband." For the purposes of my analysis, I combined these variables. In other words, if the data indicates that the vehicle, the driver, or both were searched in the course of a single traffic stop, I count this as a single instance of a search. Likewise for the discovery of contraband: if the data indicates that contraband was found through a search of the vehicle, a search of the driver, or both, I count this as a single instance of contraband found.

11. The contraband field is coded with one of eight values: 00 through 06 and 99.[10] The contraband type to which these values correspond and the frequency with which they appear in the data is listed in the table below:

Table C-1

Contraband Discovered in Traffic Stops by Type
2011–2015

Type	Code Value	Frequency
Illicit Drugs/Paraphernalia	03	2,541
Intoxicants	05	912
Weapons	01	462
Evidence of a Crime	04	297
Excessive Cash	02	179
Other	99	116
Stolen Goods	06	15

Sources:
[1] T7 TraCS traffic stop data, 2011–2015.
[2] Codes - TSContraband.csv (produced by Defendants) (MKE_0066948).

12. The T7 TraCS data also include some pedestrian stops. However, these data only include information on pedestrian stops that resulted in an arrest or Non Traffic Citation ("NTC"). MPD officers typically recorded information on pedestrian stops that did not necessarily

[10] Codes - TSContraband.csv (produced by Defendants) (MKE_0066948).

result in an arrest or citation through a software program known as Tiburon.[11] These data are stored in the MPD's Records Management System ("RMS") and are the basis for my analyses of pedestrian stops.[12]

B. Traffic and Criminal Software Electronic Citation Data

13. In this section, I provide an overview of speeding citation data produced by the MPD. MPD officers use the TraCS system when they issue a Wisconsin Uniform Traffic Citation in the course of a traffic stop.[13] In response to Plaintiffs' request for the production of data on all traffic stops conducted since January 1, 2008, Defendants produced T7 and T10 TraCS data documenting the issuance of traffic citations in spreadsheets labeled "ELCI" (short for "electronic citation").[14] The produced ELCI data, which covers the period December 2007 through June 2017, is available for both the T7 and T10 versions of TraCS and includes information on the location of the stop, the speed zone, and the excess speed at which a speeding ticket is issued. My analysis of speeding tickets utilizes only those ELCI observations that involve speeding citations; an observation is identified as involving a speeding citation if the excess speed field is populated with a numerical value.[15] The ELCI data also contain information on the characteristics of people who received electronic citations, including race and ethnicity (using the same racial "picklist" for T7 and T10 TraCS data described above). Race and ethnicity information is reasonably well-populated in the ELCI data; in contrast to the T10 TraCS traffic stop data, the T10 ELCI data includes race

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[11] Russell Letter, July 5, 2017, *supra* note 1.

[12] Further information on the RMS pedestrian stop data is provided in **Appendix C**, **Section I.C**.

[13] Russell Letter, July 5, 2017, *supra* note 1.

[14] Russell Letter, May 15, 2017, *supra* note 4, at 2 ("MPD officers use the TraCS system to issue Wisconsin Uniform Traffic Citations (form MV-4017) as an electronic citation (ELCI) and to assist in recording traffic stops and citizen contacts."); Russell Letter, July 5, 2017, *supra* note 1, at 2–3 (explaining that when MPD officers recorded traffic stops in the T7 or T10 TraCS system, they had the opportunity to file a corresponding "ELCI" form to document the issuance of an electronic citation, and that Defendants produced this data).

[15] Not all stops in the ELCI datasets concern speeding tickets. Of the total number of observations across the T7 and T10 ELCI datasets, 8.1 percent include an excess speed, and are therefore identified as involving a speeding citation.

and ethnicity information at a similar rate as its T7 counterpart. The transition from the T7 to T10 version of TraCS therefore does not impose limitations on the time period over which I can analyze ELCI data on speeding tickets. Due to the redistricting of Milwaukee police districts in 2009, however, I limit the speeding ticket analysis to data from January 2010 onward. The resulting dataset runs from January 2010 through June 2017.

C. MPD Record Management System Field Interview Data

14. Defendants produced data on the MPD's pedestrian stops for the period January 1, 2008 through April 28, 2017.[16] This data comes from information recorded by MPD officers on field interview cards using Tiburon software and stored in the MPD Records Management System ("RMS").[17,18]

15. I limit the time period of the data for the pedestrian stop analysis in two steps. First, as my analysis of pedestrian stop rates is at the year-race-district level, I limit the pedestrian stop data to full years after the 2009 redistricting, i.e. 2010 through 2016. Second, as illustrated in **Exhibit C-5**, the annual number of pedestrian stops in most MPD districts in 2011 and 2012 is significantly lower than the annual number of pedestrian stops in other years, and in fact is nearly zero in some districts. This pattern indicates data errors in pedestrian stop reporting in 2011 and 2012 and I therefore exclude those years from my analysis.

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[16] Russell Letter, May 15, 2017, *supra* note 16.

[17] A "field interview" is another term for a pedestrian stop and indicates a situation in which one or more MPD officers stop a person. *See* MILWAUKEE POLICE DEP'T, STANDARD OPERATING PROCEDURE: 085 – CITIZEN CONTACTS, FIELD INTERVIEWS, SEARCH AND SEIZURE 2 (2016), http://city.milwaukee.gov/ImageLibrary/Groups/mpdAuthors/SOP/085-CITIZENCONTACTSFIELDINTERVIEWSSEARCHANDSEIZURE2.pdf ("Field Interview[:] The brief detainment of an individual, whether on foot or in a vehicle, based on articulable reasonable suspicion, for the purposes of determining the individual's identity and resolving the member's suspicions concerning criminal activity").

[18] Russell Letter, May 15, 2017, *supra* note 4; *see also* MILWAUKEE POLICE DEP'T CRIMINAL INVESTIGATION BUREAU, CASE MANAGEMENT GUIDE 3 (Sep. 1, 2010) (produced by Defendants) (MKE_0005723).

16. The pedestrian stop data produced by the Defendants has two further deficiencies of note. First, the produced data do not contain information on the outcomes of pedestrian stops.[19] Second, the RMS data record white Hispanic/Latino pedestrians as "white."[20] As a result, it is not possible to evaluate any potential differences in the stop rates among Hispanic/Latino, Black, and white pedestrians. My analysis therefore only considers the difference between the pedestrian stop rate for people coded as "Black" and the pedestrian stop rate for people coded as "white" in the RMS data.

17. As explained in more detail below, a relatively small overlap appears to exist between the Black and Hispanic/Latino populations in Milwaukee. Insofar as the RMS system's failure to distinguish between Hispanic/Latino and other white people leads most Hispanic/Latino pedestrian stop subjects to be coded as "white," my analysis will result in a white pedestrian stop rate that is biased by its inclusion of Hispanic/Latino people. Based on my findings in the traffic stop analysis, I would expect this bias to be positive, i.e. to result in an overestimate of the white stop rate, making the difference between the stop rates of Black and white pedestrians appear smaller than it would be were I able to calculate separate stop rates for Black, white, and Hispanic/Latino pedestrians.

II. WISCONSIN DEPARTMENT OF TRANSPORTATION DRIVER'S LICENSE DATA

18. Plaintiffs in this case submitted a public records request to the Wisconsin Department of Transportation ("DOT") for electronic copies of the Division of Motor Vehicles' records concerning licensed drivers and registered vehicles for the years 2008 to 2017.[21] In response, the DOT disclosed a file of driver records that provides the race, zip code, year of birth,

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[19] *See* **Section IX** of my report.

[20] *See* MILWAUKEE POLICE DEP'T, FIELD INTERVIEWS, CONSENT SEARCHES, TRAFFIC STOP DATA COLLECTION & SSRS REPORTS (Dec. 18, 2015) (produced by Defendants) (MKE_0312367) ("Tiburon Field Interview Cards do not capture Hispanic ethnicity. Therefore, officers enter Hispanic individuals as White.").

[21] Letter from Larry Dupuis, Legal Director, ACLU of Wis. To Kristina Boardman, Wis. Dep't of Transp. (May 19, 2017).

gender, city, license type, issue date, expiration date, and status for about 7.4 million licensed drivers in the state of Wisconsin in 2015.

19. For the traffic stop analysis, I calculated the number of drivers in each U.S. Census tract in Milwaukee using the Wisconsin driver's license data disclosed by the Wisconsin Department of Transportation. I limited the driver's license data using the following criteria: licenses of type of "RGLR" (regular), a status of "VAL" (valid),[22] and expiration year greater than or equal to 2015. Because the driver's license data provides the zip code of each driver, I was able to map drivers to Census tracts using the quarterly 2010–2015 U.S. Department of Housing and Urban Development ("HUD") zip code to Census tract crosswalks.[23] Next, to calculate the number of licensed drivers in each MPD district, I summed the count of licensed drivers in all Census tracts in each district. For Census tracts that fall across the border of a district, I first determined the share of the Census tract's land area that falls in each district, then apportion drivers based on this share.

20. Because the Wisconsin Department of Transportation did not provide driver's license data for years other than 2015, the 2015 data provides a proxy for the number of drivers, by race/ethnicity and district, in the years 2011 through 2014. The distribution of licensed drivers is likely very stable, so the use of 2015 data as a proxy for the racial and ethnic composition of the licensed-driver population from 2011 through 2014 is unlikely to impact the results substantially.

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[22] Other statuses include "CAN" (cancelled), "EXP" (expired), "OTH" (other; not valid), "REV" (revoked), "SUR" (surrendered), and "SUS" (suspended). For the definitions of these acronyms, see WISDOT DIVISION OF MOTOR VEHICLES, RECORD ABSTRACT MANUAL: INTERPRETING PUBLIC DMV RECORD ABSTRACTS 18 (Dec. 2013), http://www.portal.wi.gov/register/Documents/Interpreting-DMV-Abstracts.pdf.

[23] *HUD USPS Zip Code Crosswalk Files*, U.S. DEP'T OF HOUSING AND URB. DEV., https://www.huduser.gov/portal/datasets/usps_crosswalk.html#data (last visited Jan. 31, 2018).

III. U.S. CENSUS AMERICAN COMMUNITY SURVEY

A. Data on Race and Ethnicity

21. Data on the overall Milwaukee population by race and ethnic group is taken from the U.S. Census Bureau's American Community Survey ("ACS") 1-Year Estimates, 2008–2015.

22. Data on the population of each Census tract in Milwaukee, by race and ethnic group, is taken from the ACS 5-Year Estimates, 2011–2015. This data is aggregated to the MPD district level and used to construct the Black and Latino population shares used in the traffic and pedestrian stop rate regressions described in **Sections VI** and **IX** of my report.[24] This data is also used in the construction of pedestrian stop rates in **Section IX** of my report.

B. Other Demographic Data

23. The U.S. Census Bureau's ACS 5-Year Estimates include data on population demographic characteristics, by race and ethnic group, at the Census tract level. To construct the male share of population, by race, used in the traffic and pedestrian stop rate regressions in **Sections VI** and **IX** of my report, I aggregate data from the 2011–2015 ACS 5-Year Estimates from the Census tract to the MPD district level.[25]

C. Definitions of Racial and Ethnic Groups Across Data Sources

24. Plaintiffs' complaint alleges that the conduct of stops and frisks by Milwaukee police officers results in "significant racial and ethnic disparities" and "racial and ethnic profiling" of "Black and Latino people."[26] The MPD traffic stop data produced by Defendants, however, classifies stop subjects using the ethnic group "Hispanic" rather than "Latino." The term "Hispanic" describes people from Spain or Spanish-speaking countries, especially those of

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[24] Further information on the aggregation of data from the Census tract to MPD district level is provided *infra*, **Appendix C**, **Section IV**.

[25] Further information on the aggregation of data from the Census tract to MPD district level is provided *infra*, **Appendix C**, **Section IV**.

[26] Amended Class Action Complaint for Declaratory and Injunctive Relief at ¶¶ 5, 314, Collins v. City of Milwaukee, No. 2:17-cv-00234-JPS (E.D. Wis. May 24, 2017), ECF No. 19.

Latin America, whereas the term "Latino" describes people of Latin American origin or descent, and includes people from Portuguese-speaking Brazil.

25. In practice, the distinction between "Hispanic" and "Latino" is not empirically important in Milwaukee: according to demographic data published by the United States Census Bureau, there are few residents of Milwaukee who self-identify as "Hispanic" but not "Latino," or as "Latino" but not "Hispanic."[27] In 2016, of the estimated 111,036 residents of Milwaukee of "Hispanic or Latino" origin, only 881 individuals (0.8 percent of the entire Hispanic and Latino population) identified their origin as "Spaniard" or "Spanish."[28] According to ACS 5-Year Estimates 2011–2015 data on the birthplaces of foreign-born residents of the United States, moreover, the number of Milwaukee residents born in Brazil is only about 142.[29] Because there are few residents of Milwaukee who are "Hispanic" or "Latino" but not both, I analyze MPD traffic stop data on "Hispanic" subjects along with ACS population data on people of "Hispanic or Latino" ethnicity.

26. As further reported in the 2016 ACS data, 2,145 individuals in Milwaukee identify as both "Black" and "Hispanic or Latino."[30] These individuals comprise 1.9 percent of all Hispanic or Latino individuals and 0.9 percent of all Black or African American individuals. Given the

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[27] See U.S. Census Bureau, *2011-2015 American Community Survey 5-Year Estimates: Hispanic or Latino Origin By Race (B03002)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Jan. 31, 2018), http://factfinder2.census.gov. Respondents in the American Community Census and self-report race in the following categories: (1) White, (2) Black or African American, (3) American Indian and Alaska Native, (4) Asian, (5) Native Hawaiian and Other Pacific Islander, (6) Some Other Race, or (7) Two or More Races. See also U.S. Census Bureau, *Race & Ethnicity*, U.S. CENSUS BUREAU, https://www.census.gov/mso/www/training/pdf/race-ethnicity-onepager.pdf (last visited Jan. 31, 2018); *Race and Hispanic Origin*, CENSUS REPORTER, https://censusreporter.org/topics/race-hispanic/ (last visited Jan. 31, 2018); *Table B03002: Hispanic or Latino Origin by Race*, CENSUS REPORTER, https://censusreporter.org/tables/B03002/ (last visited Jan. 31, 2018).

[28] U.S. Census Bureau, *2016 American Community Survey 1-Year Estimates: Hispanic or Latino Origin By Specific Origin (B03001)*, U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Feb. 2, 2018).

[29] U.S. Census Bureau, *2011-2015 American Community Survey 5-Year Estimates:Place of Birth for the Foreign-Born Population of the United States (B05006)*, U.S. CENSUS BUREAU, https://factfinder.census.gov (last visited Jan. 21, 2018).

[30] U.S. Census Bureau, *2016 American Community Survey 1-Year Estimates: Hispanic or Latino Origin By Race (Table B03002)* U.S. CENSUS BUREAU, http://factfinder2.census.gov (last visited Feb. 7 2018).

relatively small proportion of overlap between Black and Latino individuals, I adopt the following conventions for race and ethnicity classifications in the Census data:

i. Individuals considered "white" are those who self-report as "White" and "Not Hispanic or Latino."

ii. Individuals considered "Black" are those who self-report as "Black or African American."

iii. Individuals considered "Latino" are those who self-report as "Hispanic or Latino" but do not report their race to as "Black or African American."

IV. LOCATION DATA AND MAPPING CENSUS TRACTS AND MPD DISTRICTS

27. The MPD's traffic stop and speeding data list the location of each stop. I converted the addresses and street intersections in the data into geographic coordinates using Google Maps Geocoding. These geographic coordinates were then used to map each stop to the district where the stop occurred.[31]

28. The mapping of stop locations to MPD districts allows me to match each stop to the demographic characteristics of the district where the stop occurred. As described in **Appendix C**, **Section III**, I obtain demographic data at the Census tract level from the U.S. Census Bureau's American Community Survey. To transform this data from the Census tract level to the MPD district level, I aggregate across the Census tracts within each district. Because the boundaries of MPD districts do not neatly follow boundaries of Census tracts, some Census tracts fall in more than one district. In such cases, I allocate the Census tract's data across MPD districts according to the proportion of the Census tract's area that falls within each district.

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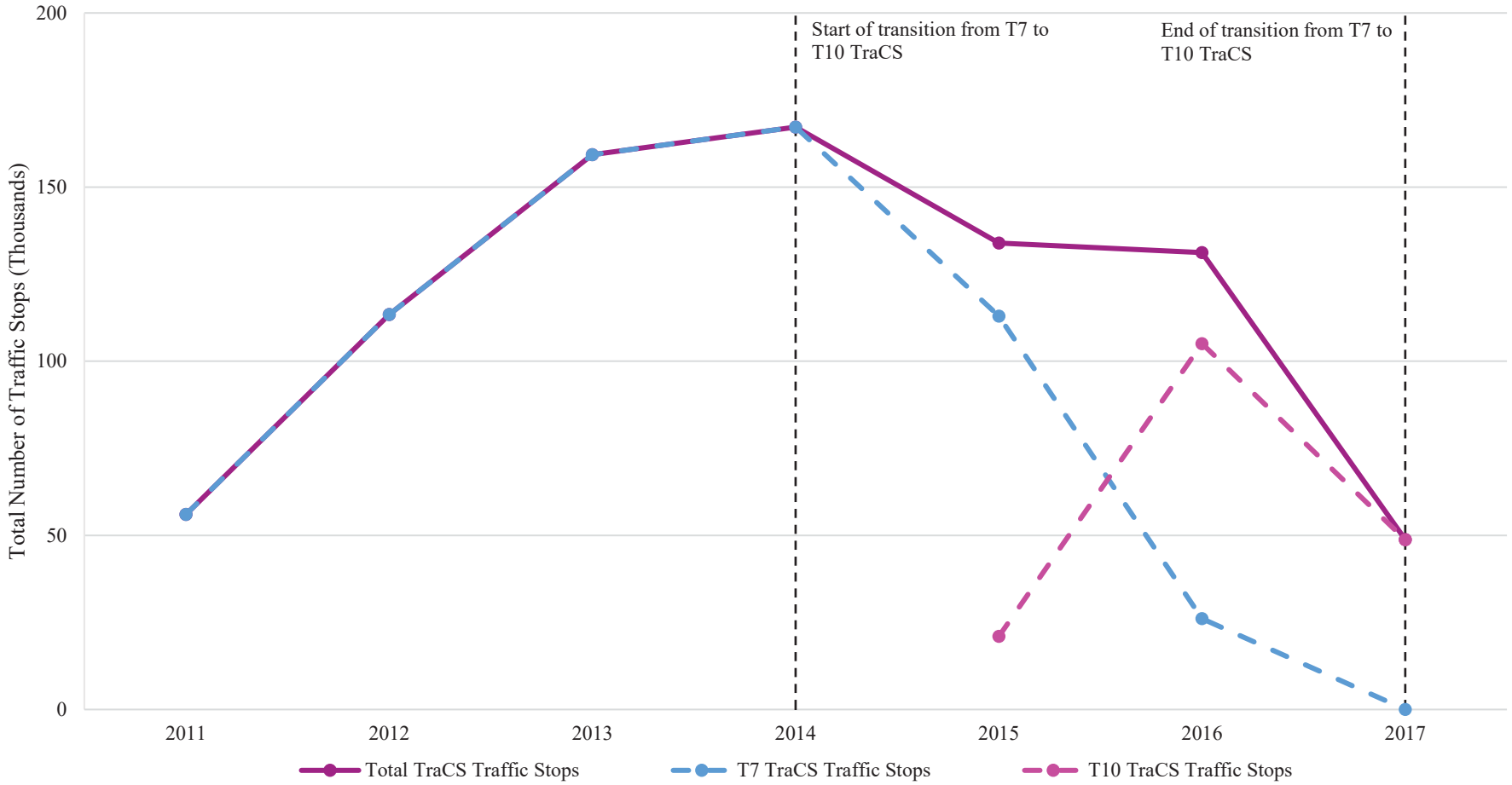
[31] 2015 Census tract and 2009 MPD district shapefiles were used throughout the mapping process. For Census tract shape files, see *2015 TIGER/Line Shapefiles: Census Tracts – Wisconsin*, U.S. CENSUS BUREAU (Aug. 19, 2015), https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2015&layergroup=Census+Tracts. For the 2009 MPD district shapefiles, see *Map Milwaukee Portal, Police Districts*, CITY OF MILWAUKEE (July 2009), http://city.milwaukee.gov/DownloadMapData3497.htm#.WiBcSoWcESt.

29. As an example, consider the allocation of population data from Census tracts to MPD districts.[32] U.S. Census Tract 41 falls across the border of District 5 and District 7, with approximately 36 percent of its area lying in District 5 and 64 percent of its area lying in District 7. Thus, I allocate 36 percent of Census Tract 41's total population to District 5 and 64 percent to District 7. Similarly, I allocate 36 percent of Census Tract 41's Black population to District 5 and 64 percent to District 7.

30. A similar allocation methodology is followed for other demographic characteristics used in my analysis. For example, I allocate 36 percent of Census Tract 41's Black male population to District 5 and 64 percent to District 7. Population share variables are constructed after the allocation of demographic data to districts is complete. For example, the Black share of each district's population is constructed as the total Black population allocated to the district divided by the total overall population allocated to the district.

[32] According to the Census tract shapefile, Census tracts along Lake Michigan include a non-trivial amount of water area. When calculating the area overlap between a Census tract and an MPD district, I adjust the total area of the Census tract to exclude any water area from the calculation.

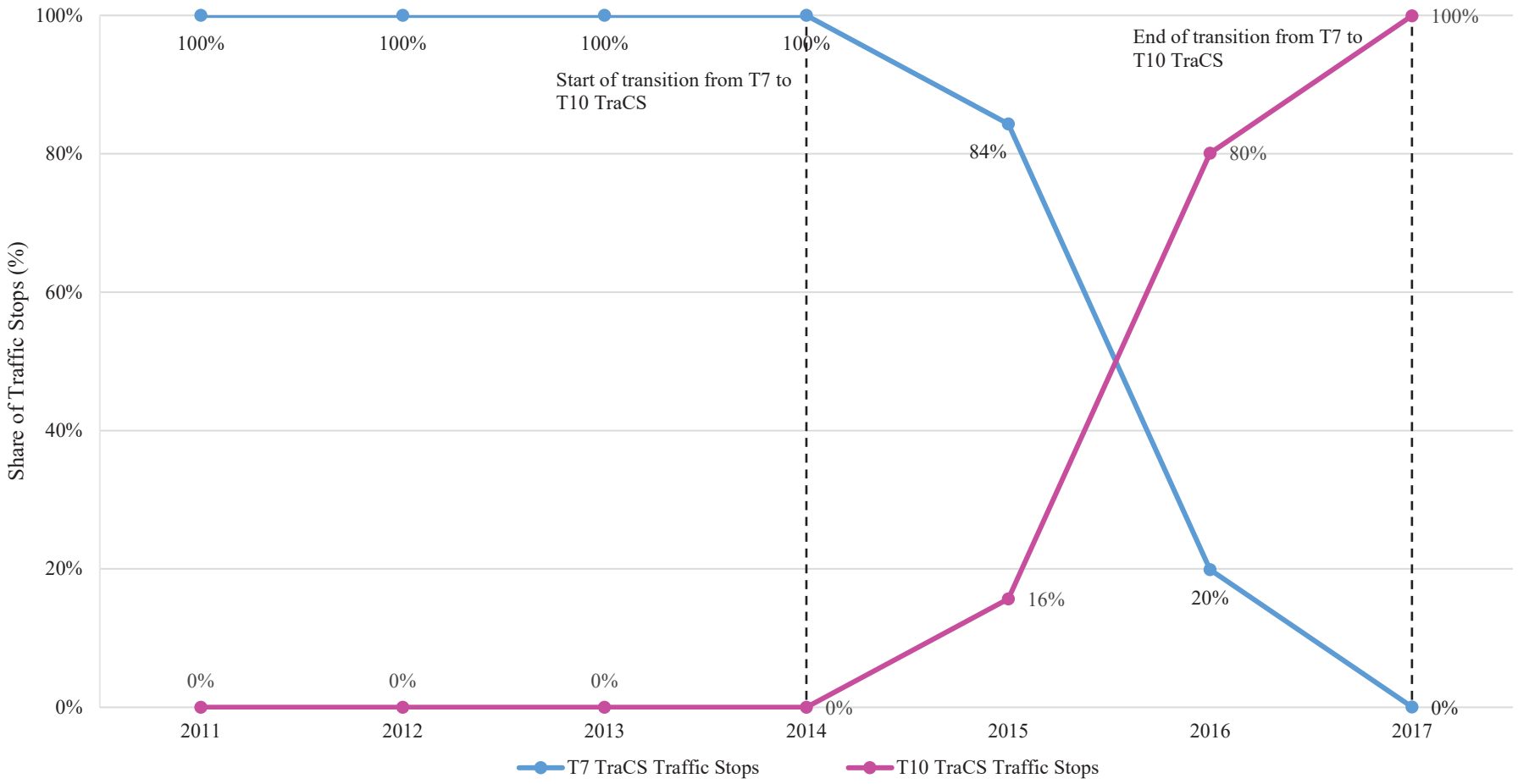
Exhibit C-1
Total Number of Traffic Stops Recorded in T7 and T10 TraCS Data
2011–2017



Notes:
[1] Defendants produced T7 TraCS traffic stop data for the period 2010–2017. T7 data in 2010 contains less than 10 stops.
[2] Defendants produced T10 TraCS traffic stop data for the period 2015–2017.
[3] Total TraCS Traffic Stops is defined as the sum of total traffic stops recorded in the T7 TraCS data and the total traffic stops recorded in the T10 TraCS data.

Sources:
[1] T7 TraCS traffic stop data, 2011–2017.
[2] T10 TraCS traffic stop data, 2015–2017.

Exhibit C-2
Share of Traffic Stops Recorded in T7 and T10 TraCS Data
2011–2017



Notes:
[1] Defendants produced T7 TraCS traffic stop data for the period 2010–2017. T7 data in 2010 contains less than 10 stops.
[2] Defendants produced T10 TraCS traffic stop data for the period 2015–2017.

Sources:
[1] T7 TraCS traffic stop data, 2011–2017.
[2] T10 TraCS traffic stop data, 2015–2017.

Exhibit C-3
Share of Traffic Stops with Missing Demographic Information
T7 and T10 TraCS Data
2011–2017

	Number of Stops		Share of Stops Missing Demographic Information		Number of Stops with Complete Demographic Information	
Year	**T7**	**T10**	**T7**	**T10**	**T7**	**T10**
2011	56,041	0	0%	n/a	56,017	0
2012	113,442	0	0%	n/a	113,439	0
2013	159,277	0	0%	n/a	159,259	0
2014	167,230	0	0%	n/a	167,218	0
2015	112,937	20,989	0%	36%	112,926	13,530
2016	26,103	105,072	0%	47%	26,103	55,697
2017	23	48,747	0%	47%	23	25,884
Total	635,053	174,808	0%	46%	634,985	95,111

Notes:

[1] Each observation in the data represents a single traffic stop.

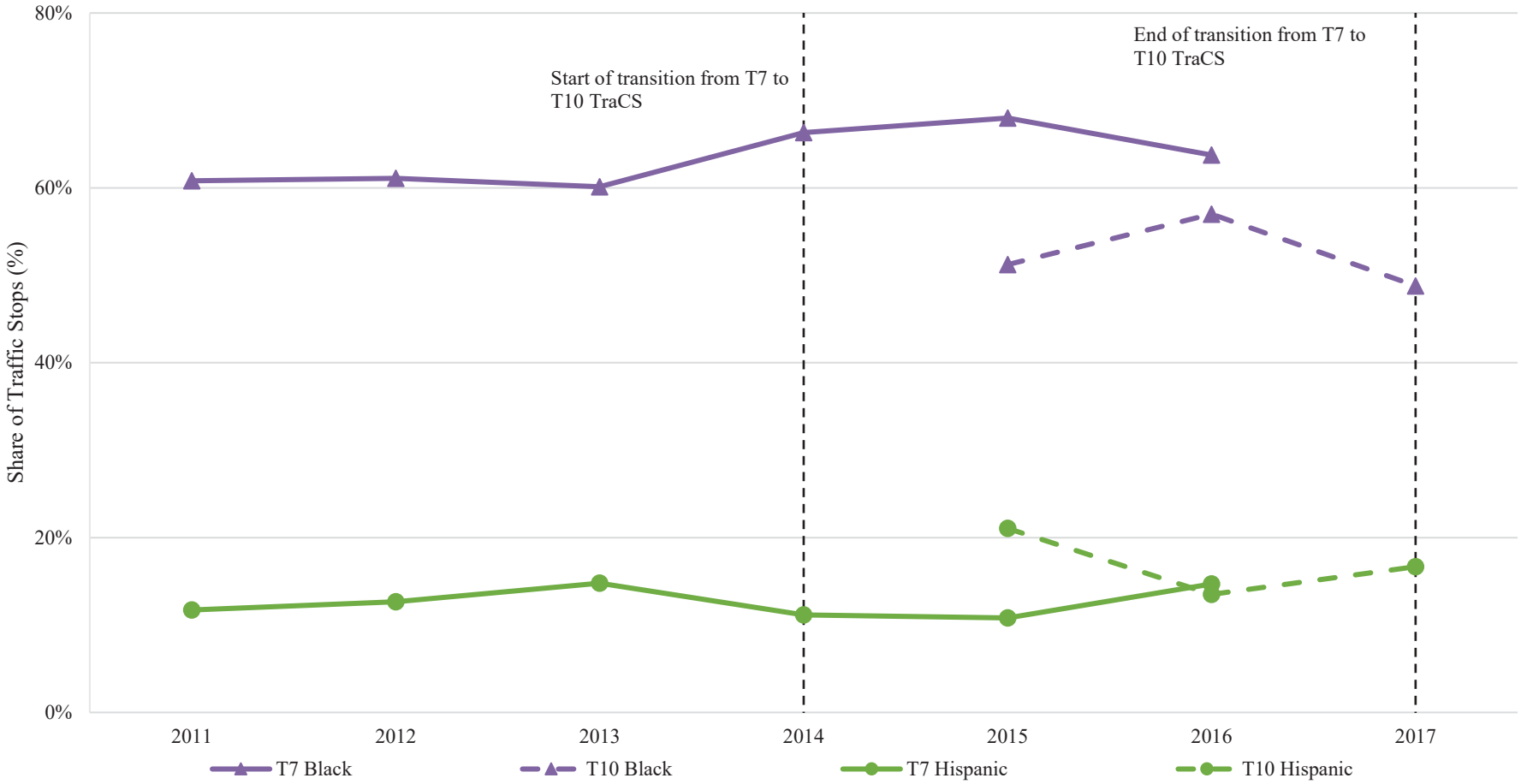
[2] An observation is considered to be missing demographic information if information on subject race/ethnicity or gender was not recorded in the TRaCS data.

Sources:

[1] T7 TraCS traffic stop data, 2011–2017.

[2] T10 TraCS traffic stop data, 2015–2017.

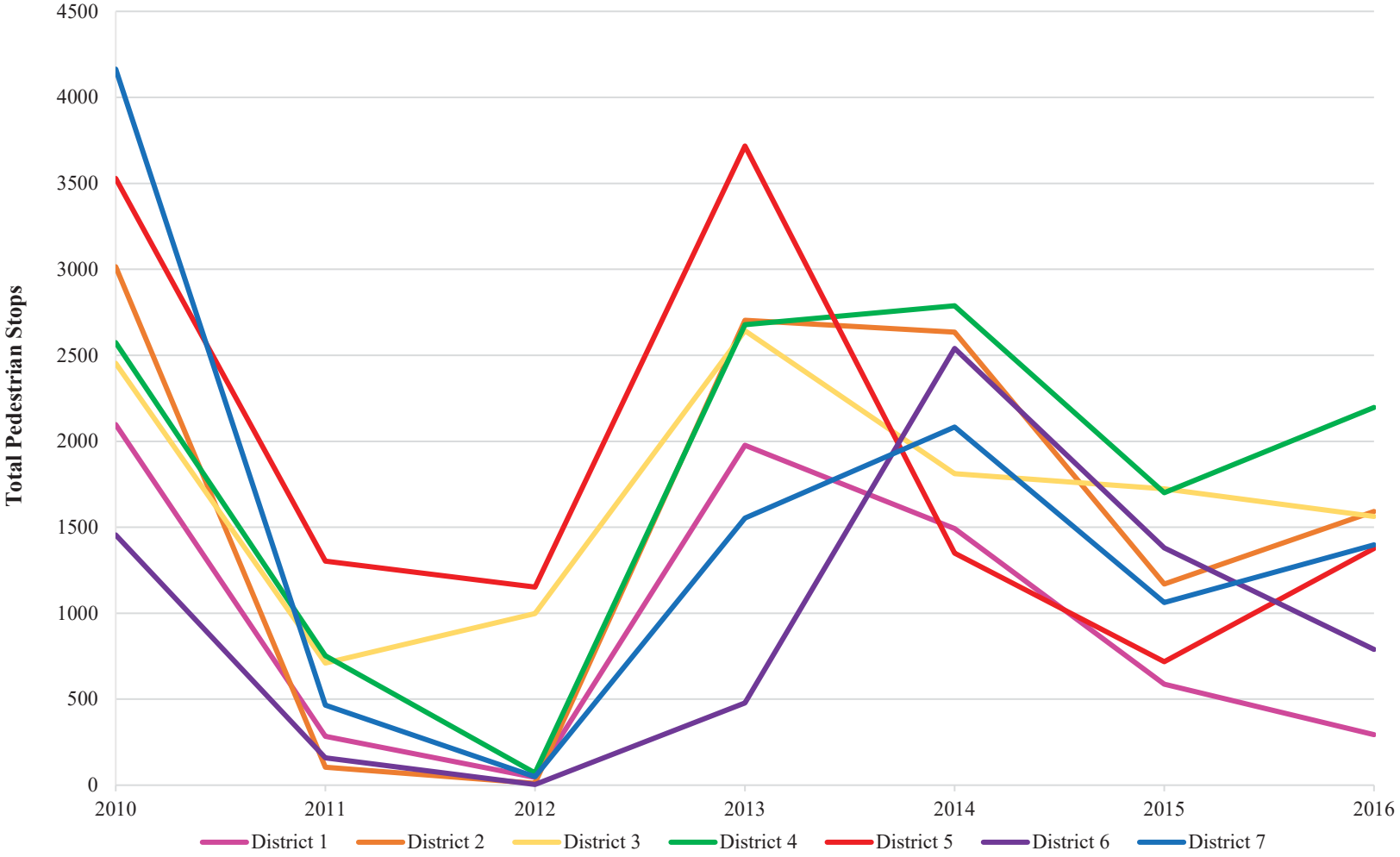
Exhibit C-4
Black and Hispanic Share of Traffic Stops Recorded in T7 and T10 TraCS Data
2011–2017



Notes:
[1] Defendants produced T7 TraCS traffic stop data for the period 2010–2017. Data from 2010 and 2017 are not displayed because there were fewer than 30 traffic stops.
[2] Defendants produced T10 TraCS traffic stop data for the period 2015–2017.
[3] Stops with a missing race/ethnicity or gender are not included.

Sources:
[1] T7 TraCS traffic stop data, 2011–2017.
[2] T10 TraCS traffic stop data, 2015–2017.

Exhibit C-5
Pedestrian Stops in RMS Data by District and Year
2010–2016



Note:
[1] This graph plots pedestrian stops in the produced data for full years after the 2009 redistricting.

Source:
[1] RMS Incidents Related to Calls for Service FI Person, 2010–2016.

Appendix D

Exhibit D-1
Summary of Variables in Traffic Stop Rate Analysis

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Stop Rate	59.76	64.08	4.12	409.56	105
Black	0.33	0.47	0.00	1.00	105
Latino	0.33	0.47	0.00	1.00	105
Black Share of District	39.42	28.38	4.15	74.23	105
Latino Share of District	16.84	22.03	3.58	68.12	105
White Share of District	36.98	22.99	17.18	77.99	105
Lagged Total Crime Rate in District	784.30	233.61	333.82	1272.74	105
Male Share of Population	50.15	4.12	43.29	60.70	105

Notes:

[1] The unit of observation in the stop rate analysis is MPD district × race × year.

[2] The dataset contains one observation for each race or ethnicity (Black, Latino, and white) in each MPD district in each year. By construction, therefore, the Black and Latino indicator variables have a mean of one third, or 0.33.

[3] The variable "Lagged Total Crime Rate in District" is the total crime rate per 10,000 residents in the prior year, by MPD district.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Demographic, crime, driver license, and mapping data, as discussed in the report text and Appendix C.

Exhibit D-2
Estimation Results: Traffic Stop Rate

Dependent Variable: Traffic Stops Per 100 Drivers	[1]	[2]	[3]	[4]
Black	98.78***	98.78***	102.2***	102.6***
	(23.43)	(23.67)	(22.08)	(22.94)
Latino	27.14***	27.14***	15.33	14.01
	(3.891)	(3.930)	(10.06)	(13.86)
Black Share of District		-0.256	-0.345	
		(0.421)	(0.272)	
Latino Share of District		0.785*	0.997***	
		(0.379)	(0.205)	
Lagged Total Crime Rate in District			0.0598*	-0.0631
			(0.0255)	(0.0449)
Male Share of Population			3.540*	3.934
			(1.720)	(2.705)
Year Fixed Effects				X
District Fixed Effects				X
Constant	17.79***	14.67	-207.0**	-160.4
	(3.589)	(25.49)	(82.53)	(165.8)
Observations	105	105	105	105

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] Observations in the data are at the level of race, district, and year.

[3] The dependent variable is the total number of traffic stops per 100 licensed drivers, by race, district, and year.

[4] Each variable's coefficient measures its relationship with the stop rate per 100 licensed drivers.

[5] Subjects stopped with a race of Asian or Indian are excluded from the analysis.

[6] The variable "Lagged Total Crime Rate in District" is the total crime rate per 10,000 residents in the prior year, by district.

[7] "Male Share of Population" is based on the residential population and varies by district and race.

[8] "Black Share of District" and "Latino Share of District" are omitted from specification 4 because they vary only by district, and their effects therefore cannot be estimated simultaneously with district fixed effects.

[9] Standard errors are clustered by MPD district.

[10] In specification 1, the constant provides an estimate of the white traffic stop rate.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Demographic, crime, driver license, and mapping data, as discussed in the report text and Appendix C.

Exhibit D-3
Summary of Variables in Analyses of the Rate of Contraband Discovery in Traffic Stop Searches

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Indicator Variable for Contraband Discovery * 100	27.17	44.48	0.00	100.00	14,480
Indicator Variable for Drug Discovery * 100	17.54	38.03	0.00	100.00	14,480
Indicator Variable for Weapon Discovery * 100	3.19	17.58	0.00	100.00	14,480
Black Driver	0.74	0.44	0.00	1.00	14,480
Latino Driver	0.13	0.34	0.00	1.00	14,480
Male Driver	0.91	0.28	0.00	1.00	14,480
Age of Driver	27.90	9.44	13.00	91.00	14,480
Time of day: 3:00 pm - 8:59 pm	0.41	0.49	0.00	1.00	14,480
Time of day: 9:00 pm - 2:59 am	0.43	0.50	0.00	1.00	14,480
Time of day: 3:00 am - 8:59 am	0.02	0.15	0.00	1.00	14,480
Time of day: 9:00 am - 2:59 pm	0.14	0.35	0.00	1.00	14,480

Note:

[1] Data for the contraband discovery rate analysis is at the level of the individual search. The sample for this analysis is restricted to stops involving searches.

Source:

[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit D-4
Summary of Variables in Analysis of Traffic Stop Search Rate

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Black Driver	0.66	0.48	0.00	1.00	580,816
Latino Driver	0.13	0.33	0.00	1.00	580,816
White Driver	0.22	0.41	0.00	1.00	580,816
Male Driver	0.64	0.48	0.00	1.00	580,816
Age of Driver	33.41	12.68	11.00	98.00	580,816
Description: Speed Violation	0.12	0.32	0.00	1.00	580,816
Description: Vehicle Registration	0.33	0.47	0.00	1.00	580,816
Description: Seat belt	0.02	0.15	0.00	1.00	580,816
Description: Impaired Driving	0.03	0.18	0.00	1.00	580,816
Description: Vehicle Equipment Violation	0.31	0.46	0.00	1.00	580,816
Description: Stolen Auto	0.00	0.02	0.00	1.00	580,816
Description: Burglary Investigation	0.01	0.09	0.00	1.00	580,816
Description: Other Rules of the Road	0.12	0.32	0.00	1.00	580,816
Time of day: 3:00 pm - 8:59 pm	0.35	0.48	0.00	1.00	580,816
Time of day: 9:00 pm - 2:59 am	0.36	0.48	0.00	1.00	580,816
Time of day: 3:00 am - 8:59 am	0.09	0.28	0.00	1.00	580,816
Time of day: 9:00 am - 2:59 pm	0.20	0.40	0.00	1.00	580,816

Note:

[1] Data for the traffic stop search rate analysis is at the level of the individual stop.

Source:

[1] T7 TraCS traffic stop data, 2011–2015.

Exhibit D-5
Estimation Results:
Traffic Stop Search Rate with District-Specific Race Effects
Page 1 of 2

Dependent Variable: Indicator Variable for Search * 100	[1]	[2]	[3]	[4]
White, District 1	0.506***	1.501***	-0.147	1.501***
	(0.0436)	(0.0629)	(0.0969)	(0.129)
Latino, District 1	1.355***	1.913***	0.317	2.040***
	(0.205)	(0.210)	(0.221)	(0.237)
Black, District 1	1.709***	2.586***	1.060***	2.808***
	(0.0985)	(0.108)	(0.128)	(0.157)
White, District 2	2.194***	3.457***	1.872***	3.446***
	(0.102)	(0.116)	(0.133)	(0.159)
Latino, District 2	3.086***	3.679***	2.044***	3.622***
	(0.0851)	(0.0948)	(0.116)	(0.144)
Black, District 2	3.317***	4.054***	2.446***	4.020***
	(0.118)	(0.125)	(0.143)	(0.166)
White, District 3	1.599***	3.039***	1.334***	2.947***
	(0.105)	(0.118)	(0.138)	(0.163)
Latino, District 3	1.890***	2.763***	1.118***	2.750***
	(0.219)	(0.223)	(0.231)	(0.246)
Black, District 3	3.162***	4.051***	2.489***	4.109***
	(0.0593)	(0.0750)	(0.103)	(0.134)
White, District 4	1.842***	3.339***	1.980***	3.562***
	(0.156)	(0.165)	(0.180)	(0.200)
Latino, District 4	1.274***	2.282***	1.034***	2.632***
	(0.316)	(0.319)	(0.327)	(0.337)
Black, District 4	1.377***	2.418***	1.016***	2.609***
	(0.0490)	(0.0671)	(0.102)	(0.132)
White, District 5	1.771***	2.784***	1.294***	2.927***
	(0.119)	(0.128)	(0.150)	(0.171)
Latino, District 5	2.845***	3.587***	2.109***	3.767***
	(0.326)	(0.327)	(0.336)	(0.346)
Black, District 5	3.529***	4.376***	2.794***	4.421***
	(0.0631)	(0.0790)	(0.108)	(0.138)
White, District 6	1.261***	2.669***	1.140***	2.611***
	(0.0589)	(0.0809)	(0.111)	(0.138)
Latino, District 6	2.148***	2.816***	1.278***	2.785***
	(0.104)	(0.113)	(0.136)	(0.159)
Black, District 6	2.287***	3.201***	1.696***	3.198***
	(0.151)	(0.157)	(0.174)	(0.193)
White, District 7	2.174***	3.759***	2.431***	4.118***
	(0.149)	(0.160)	(0.172)	(0.193)
Latino, District 7	1.699***	2.736***	1.401***	3.086***
	(0.308)	(0.310)	(0.316)	(0.327)
Black, District 7	2.844***	3.807***	2.404***	4.027***
	(0.0521)	(0.0710)	(0.102)	(0.133)
Male Driver		2.875***	2.695***	2.691***
		(0.0346)	(0.0340)	(0.0339)
Age of Driver		-0.0842***	-0.0764***	-0.0758***
		(0.00140)	(0.00140)	(0.00140)

[continued on next page]

Exhibit D-5
Estimation Results:
Traffic Stop Search Rate with District-Specific Race Effects
Page 2 of 2

Dependent Variable: Indicator Variable for Search * 100	[1]	[2]	[3]	[4]
[continued from previous page]				
Description: Speed Violation			0.279***	0.292***
			(0.0852)	(0.0851)
Description: Vehicle Registration			0.167**	0.876***
			(0.0682)	(0.0704)
Description: Seat Belt			6.541***	6.665***
			(0.254)	(0.254)
Description: Impaired Driving			3.075***	2.114***
			(0.168)	(0.175)
Description: Vehicle Equipment Violation			-0.0621	0.713***
			(0.0681)	(0.0704)
Description: Stolen Auto			27.44***	28.36***
			(2.828)	(2.818)
Description: Burglary Investigation			3.699***	2.730***
			(0.353)	(0.355)
Description: Other Rules of the Road			1.340***	2.093***
			(0.0916)	(0.0933)
Time-of-Day Fixed Effects			X	X
Year Fixed Effects				X
Observations	580,816	580,816	580,816	580,816

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period 2011–2015.

[2] The dependent variable is an indicator variable equal to one if the traffic stop subject was searched and zero otherwise, times 100.

[3] Observations in the data are at the level of the individual driver stop.

[4] Each variable's coefficient measures its relationship with the rate of searches per 100 traffic stops.

[5] Subjects stopped with a race of Asian or Indian are excluded.

Sources:

[1] T7 TraCS traffic stop data, 2011–2015.

[2] Mapping data, as discussed in the report text and Appendix C.

Exhibit D-6
Summary of Variables in Speeding Analysis

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Probability of Being Charged at Lenient Speeds	0.24	0.43	0.00	1.00	34,839
Black Driver	0.62	0.49	0.00	1.00	34,839
Latino Driver	0.14	0.34	0.00	1.00	34,839
White Driver	0.24	0.43	0.00	1.00	34,839
Male Driver	0.62	0.49	0.00	1.00	34,839
Age of Driver	31.46	11.56	13.00	90.00	34,839
Height (Inches)	67.96	4.00	56.00	85.00	34,839
Weight (Pounds)	176.87	40.58	80.00	440.00	34,839
Speed Limit	30.38	2.62	15.00	55.00	34,839

Note:

[1] Data for the speeding analysis is at the level of speeding ticket for the period January 2010–June 2017.

Sources:

[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.

[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

Exhibit D-7
Probability of Being Charged at Lenient Speeds

Dependent Variable: Indicator Variable Equal to 1 if Ticket Issued for Lenient Speed	[1]	[2]	[3]	[4]	[5]
Black	-0.067***	-0.060***	-0.062***	-0.056***	-0.034**
	(0.019)	(0.017)	(0.017)	(0.016)	(0.015)
Latino	-0.058***	-0.047***	-0.052***	-0.045***	-0.045***
	(0.018)	(0.017)	(0.016)	(0.015)	(0.012)
Subject Male		-0.028***	-0.020***	-0.018**	-0.015*
		(0.006)	(0.008)	(0.007)	(0.008)
Subject Age		0.006***	0.006***	0.006***	0.006***
		(0.001)	(0.002)	(0.001)	(0.001)
Subject Age Squared		-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)
Subject Height (Inches)			-0.002***	-0.002***	-0.002***
			(0.001)	(0.001)	(0.001)
Subject Weight (Pounds)			0.000	0.000*	0.000
			(0.000)	(0.000)	(0.000)
Speed Limit				0.002	0.004
				(0.003)	(0.003)
Year Fixed Effects				X	X
Quarter Fixed Effects				X	X
Weekday Fixed Effects				X	X
District Fixed Effects					X
Constant	0.287***	0.167***	0.280***	0.228*	0.104
	(0.028)	(0.030)	(0.044)	(0.117)	(0.122)
Observations	34,839	34,839	34,839	34,839	34,839

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the period January 2010–June 2017.

[2] Each observation represents a speeding violation of a driver.

[3] Standard errors are clustered by police officer badge number.

[4] In specification 1, the constant provides an estimate of the probability that a white driver's ticket is issued at a lenient speed.

Sources:

[1] T7 TraCS ELCI data, January 1, 2010–October 26, 2016.

[2] T10 TraCS ELCI data, October 12, 2014–June 25, 2017.

[3] Mapping data, as discussed in the report text and Appendix C.

Exhibit D-8
Summary of Variables in Pedestrian Stop Rate Analysis

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Stop Rate	3.92	4.56	0.25	19.71	70
Black	0.50	0.50	0.00	1.00	70
Black Share of District	39.01	28.46	3.77	73.61	70
White and Latino Share of District	53.82	28.76	22.28	89.68	70
Lagged Total Crime Rate in District	788.21	228.78	333.82	1360.08	70
Male Share of Population in District	49.23	3.75	43.29	59.36	70

Notes:

[1] The unit of observation in the stop rate analysis is MPD district × race × year.

[2] The dataset contains one observation for each race (Black and white) in each MPD district in each year. By construction, therefore, the Black indicator variable has a mean of 0.5.

[3] The variable "Lagged Total Crime Rate in District" is the total crime rate per 10,000 residents in the prior year, by MPD district.

Sources:

[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.

[2] Demographic, crime, and mapping data, as discussed in the report text and Appendix C.

Exhibit D-9
Estimation Results: Pedestrian Stop Rate

Dependent Variable: Pedestrian Stops Per 100 People	[1]	[2]	[3]	[4]
Black	5.600***	5.600***	6.150***	6.613***
	(1.324)	(1.334)	(0.900)	(0.818)
Black Share of District		-0.065***	-0.058***	
		(0.010)	(0.015)	
Lagged Total Crime Rate in District			0.003	0.009
			(0.002)	(0.005)
Male Share of Population in District			0.331**	0.611***
			(0.091)	(0.116)
Year Fixed Effects				X
District Fixed Effects				X
Constant	1.116***	3.637***	-15.400***	-37.468***
	(0.213)	(0.720)	(3.392)	(9.146)
Observations	70	70	70	70

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:

[1] These regressions are based on data for the years 2010 and 2013–2016. The years 2011–2012 are omitted due to concerns about the completeness of the produced data.

[2] Observations in the data are at the level of race, MPD district, and year.

[3] The dependent variable is the total number of pedestrian stops per 100 people, by race, MPD district, and year.

[4] Each variable's coefficient measures its relationship with the pedestrian stop rate per 100 people.

[5] The MPD data on pedestrian stops codes Hispanic/Latino individuals as "white," so the base group for these regressions combines Latino and white people.

[6] Subjects stopped with a race of Asian or Indian are excluded from the analysis.

[7] The variable "Lagged Total Crime Rate in District" is the total crime rate per 10,000 residents in the prior year, by MPD district.

[8] "Male Share of Population" is based on the resident population and varies by MPD district and race.

[9] "Black Share of District" is omitted from specification 4 because it varies only by MPD district, and its effect therefore cannot be estimated simultaneously with district fixed effects.

[10] Standard errors are clustered by MPD district.

[11] In specification 1, the constant provides an estimate of the white (and Latino) pedestrian stop rate.

Sources:

[1] RMS Incidents Related to Calls for Service FI Person, 2010 and 2013–2016.

[2] Demographic, crime, and mapping data, as discussed in the report text and Appendix C.