Gies College of Business
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Department of Finance
515 Gregory Drive | Champaign, IL 61820

April 18, 2023

Dear Members of the Selection Committee,

I am writing to apply for the Review of Economics and Statistics Fellowship for the National Bureau of Economic Research Summer Institute (SI). I am an Assistant Professor at the University of Illinois at Urbana-Champaign in the Department of Finance who studies how (perceptions of) discrimination and disparities affect employees at work and people in their everyday lives. Therefore, my research interests fit well with the SI sessions on Labor Studies and also relate to Crime and Public Economics.

As an example of my current work in labor economics, Sarah Jacobson and I study how faculty's productivity is affected by major societal events in "Black Lives Matter for Productivity: Heterogeneous Impacts of the 2020 Social Justice Movement on Faculty." We created a survey that we administered to social science faculty in 2020 to measure how they felt their research, teaching, and service were impacted by the murder of George Floyd in May 2020 and the subsequent social justice movement. While both Black and White scholars report negative impacts on their ability to concentrate and their motivation to work on research and teaching, Black scholars felt these negative impacts more strongly. Relatedly, many of our respondents report that they spend less time on research as a result of the social justice movement. On the other hand, time spent on service increased. In particular, Black scholars report spending twice as much time on service related to diversity, equity, and inclusion than White scholars. As such, when major societal events occur that are connected to an employee's identity, their task allocation at work may change and their productivity may be negatively impacted. This paper is currently under review.

To provide an example of my work in crime, I have attached my paper "Does Black and Blue Matter?: An Experimental Investigation of Race and Perceptions of Police Bias" with Emily Owens. Motivated by recent policy recommendations to diversify police departments, we designed an experiment to test whether legal compliance and beliefs about the probability of punishment depend on the racial representativeness of police departments. In the experiment, we describe a real but unnamed city to participants and ask them to state how fast they want to drive in a driving simulation game. Their earnings increase if they drive fast; however, they lose their earnings if they receive a speeding ticket. The probability that they receive a ticket is unknown to participants, but they are truthfully told it depends on data we have about them (e.g., their race) and data we have about real-life drivers and police officers in the city (e.g., the fraction of White police officers, the race and recorded speed of drivers who received a ticket). We find that Black participants believe they are more likely to receive a ticket, conditional on speed, than White participants. Black participants also drive slower than White participants. Interestingly, Black participants drive the same speed, regardless of how racially representative the police department is. It is, in fact, the White participants who respond to the diversity of the police department; they drive faster when the racial demographics of the city differ from the racial demographics of the police department. Therefore, policies to diversity police departments may increase legal compliance; however, this may not be driven by attitude changes from racial minorities but rather behavior differences from White citizens. This paper will be submitted next month.

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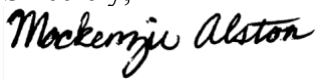
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The rest of my current work relates to discrimination and disparities as well. For example, I am currently developing a field experiment with co-authors to test whether there are heterogeneous effects on how academics benefit from social media (e.g., if female academics receive more seminar invitations than male academics).

Having had the fortune to attend the NBER SI in the past, I am aware of how professionally beneficial participating in these meetings can be. I would have the opportunity to learn about the latest research done by scholars at the top of the field, receive feedback from others about my own work, and meet potential letter writers, which is particularly important as I approach tenure. In addition, because both women work at Harvard, I would schedule time after the talks to meet with my co-author, Mandy Pallais, to discuss a new experiment we are designing and my mentor, Katie Coffman, to receive professional advice.

I have attached my application materials to this file. Please feel free to contact me at 262-573-2830 or mjalston@illinois.edu if you require additional information. Thank you for your time and consideration.

Sincerely,



Name: Mackenzie Alston
Email Address: mjalston@illinois.edu
Current University Affiliation: University of Illinois at Urbana-Champaign, Department of Finance
Date of Ph.D.: May 2019
Link to Personal Website: www.mackenziealston.com
Sessions Most Interested in Attending (in order): Labor Studies, Crime, and Public Economics

MACKENZIE ALSTON

CONTACT INFORMATION

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Citizenship: USA

PROFESSIONAL POSITIONS

Assistant Professor of Finance, Gies College of Business, University of Illinois at Urbana-Champaign	August 2022 – present
Faculty Affiliate, Notre Dame Wilson-Sheehan Lab for Economic Opportunities	April 2021 – present
Assistant Professor of Economics, Florida State University	August 2019 – August 2022
Postdoctoral Fellow, National Bureau of Economic Research	Sept. 2021 – May 2022
Assistant Professor, AEA Summer Program, Michigan State University	June 2020

EDUCATION

Ph.D. in Economics, Texas A&M University	May 2019
A.B. in Economics and Mathematics (cum laude), Washington University in Saint Louis	December 2013

FIELDS OF SPECIALIZATION

Experimental Economics, Behavioral Economics, Labor, Education

PEER-REVIEWED PUBLICATIONS

Alston, M., Darity, W. A., Eckel, C. C., McNeil, L., & Sharpe, R. (2022). The effect of stereotypes on black college test scores at a historically black university. *Journal of Economic Behavior & Organization*, *194*, 408-424.

Alston, M., Eckel, C., Meer, J., and Zhan, W. (2021). High-Capacity Donors' Preferences for Charitable Giving. *Nonprofit and Voluntary Sector Quarterly, 50*(6), 1262-1273.

OTHER PUBLICATIONS

Jaeger, D. A., Arellano-Bover, J., Kryzstof, K., Martínez-Matute, Nunley, J. M., Seals, R. A., Alumnia, M., **Alston, M.**, Becker, S. O., Beneito, P., Böheim, R., Boscá, J.E., Brown, J. H., Chang, S., Cobb-Clark, D., Danagoulian, S., Donnally, S., Eckrote-Nordland, M., Farré, L.,..., Zhu, M. (2021). The Global COVID-19 Student Survey: First Wave Results. *Covid Economics, 79*(1), 152-217.

Alston, M. (2015). The Effect of Dropping Lowest Test Scores on Learning and Performance. *Equilibria, 3*(1), 13-18.

WORKING PAPERS

"Black Lives Matter for Productivity: Heterogeneous Impacts of the 2020 Social Justice Movement on Faculty" with Sarah Jacobson (under review)

"Does Black and Blue Matter?: An Experimental Investigation of Race and Perceptions of Police Bias" with Emily Owens

"Eliminating Discrimination in Hiring Isn't Enough" (accepted at *IZA World of Labor*)

"The (Perceived) Cost of Being Female: An Experimental Investigation of Strategic Responses to Discrimination"

WORKS IN PROGRESS

"The Effect of Institutional Responses to the Pandemic and Social Justice Movement on Faculty Job Attachment" with Sarah Jacobson

PRESENTATIONS

*indicates participation in panel

2023: Vienna University of Economics and Business (invited), NBER Race and Ethnic Health Disparities meeting (planned), Discrimination in the 21st Century: Fostering Conversations Across Fields (planned, discussant), Williams College (planned, invited), Purdue University (planned, invited), University of Utah (planned, invited), University of Alabama at Birmingham (planned, invited)

2022: AEA/ASSA Annual Meeting, Kent State University (invited), Kansas State University (invited), Midwestern Economic Association Conference, Harvard Economics Department (invited), Census Bureau Center for Economic Studies (invited), University of Pennsylvania (invited), Indiana University (invited), Diversity Initiative for Tenure in Economics, HUD Housing Discrimination Study Innovative Methodology Conference* (invited), Southern Economic Association Conference (presentation and discussant), ESA Job Market Paper Seminar Series (discussant)

2021: AEA/ASSA Annual Meeting (discussant), University of Tennessee – Knoxville (invited), Western Illinois University (invited), Duke (invited), University of Michigan (invited), Pitt Behavioral/Experimental Seminar (invited), NBER Race and Stratification in the Economy Working Group (discussant), John List's UChicago Workshop (invited), University of Hamburg (invited), Discrimination and Disparities Seminar, AEA Summer Mentoring Pipeline Conference (presentation and panelist*), Diversity Initiative for Tenure in Economics, Economics of Crime Workshop, Harvard Kennedy School (planned, invited), MIT Sloan (invited), Federal Reserve Conference on Diversity and Inclusion in Economics, Finance, and Central Banking, Boston University (invited), Southern Economic Association Conference (presentation x2, session co-organizer x2)

2020: AEA/ASSA Annual Meeting (discussant), Penn Wharton Conference on Race and Economics* (invited), Southern Economic Association Conference, Cornell University (invited)

2019: AEA/ASSA Annual Meeting, AEA Mentoring Pipeline Conference*, Southern Economic Association Conference, Science of Diversity & Inclusion Initiative Conference

2018: Virginia Tech Seminar (invited), University of West Virginia Seminar (invited), Southern Economic Association Conference*, UCSD Rady School of Management Seminar (invited), AEA Mentoring Program Job Market Bootcamp, Norms and Behavioral Change Workshop, AEA Mentoring Pipeline Conference, World Economic Science Association Conference, Spring School in Behavioral Economics Poster Conference

2017: Southern Economic Association Conference, Science of Philanthropy Initiative Conference, AEA Mentoring Pipeline Conference, World Economic Science Association Conference, Texas Experimental Association Symposium

2016: North American Economic Science Association Conference, American Society of Hispanic Economists Conference

2013: Ohio Undergraduate Research Symposium Poster Conference

2012: AEA Mentoring Pipeline Conference

FELLOWSHIPS AND AWARDS

Gies Research Grant for "Understanding the Role of Social Media in Academic Careers," University of Illinois at Urbana-Champaign ($34,967)	December 2022
Gies Research Grant for "Is It Because I'm Black?: Experimental Evidence on the Impacts of Diversity Hiring," University of Illinois at Urbana-Champaign ($29,502)	December 2022
College of Social Science and Public Policy Research Support Summer Grant, Florida State University ($7,000)	March 2022
Undergraduate Research Opportunities Program Materials Grant, Florida State University ($472)	January 2022
AEA Mentoring Program Travel Award, AEA Pipeline Mentoring	January 2021
Race, Equity, and Justice Research Grant, Florida State University ($3,500)	November 2020
Review of Economics and Statistics Fellowship for NBER Summer Institute	May 2020
First Year Assistant Professor Program Grant, Florida State University ($20,000)	March 2020

	Undergraduate Research Opportunities Program Materials Grant, Florida State University ($500)	February 2020
	Provost's Faculty Travel Grant, Florida State University	November 2019
	AEA Mentoring Program Travel Awards, AEA Pipeline Mentoring	2017 – 2018
	Graduate Diversity Fellowship, Texas A&M University	2014 – 2017
	Equity and Inclusion Fellowship, Association for Public Policy Analysis & Management	November 2017
	John Van Huyck Fellowship, Texas A&M University	October 2017
	Teaching Fellowship, AEA Summer Program, Michigan State University	July 2017
	M.J. Grove Fellowship, Private Enterprise Research Center, Texas A&M University	Summer 2016
	Outstanding July Teaching Fellow Award (Foundation Level), AEA Summer Program, Michigan State University	July 2016
	Teaching Fellowship, AEA Summer Program, Michigan State University	July 2016
	Lechner Graduate Grant, Texas A&M University	Fall 2014
TEACHING EXPERIENCE	*Instructor, University of Illinois at Urbana-Champaign* Methods in Surveys and Experiments for Business and Economics (Graduate)	Spring 2023
	Instructor, Florida State University Labor Economics (Undergraduate) Experimental Economics (Undergraduate)	2019 – 2021
	Instructor, AEA Summer Program, Michigan State University Advanced Mathematical Methods for Economic Analysis (Undergraduate)	June 2020
	Instructor, Texas A&M University Experimental Economics (Undergraduate)	Summer 2018
	Co-Instructor, AEA Summer Program, Michigan State University Foundations of Mathematical Methods for Economic Analysis (Undergraduate)	July 2017
	Teaching Fellow, AEA Summer Program,	July 2016

	Michigan State University Foundations of Mathematical Methods for Economic Analysis (Undergraduate)	
	Teaching Assistant, Texas A&M University Economic Data Analysis (Undergraduate) Experimental Economics (Graduate) Research in Experimental Economics (Undergraduate) Experimental Economics (Undergraduate)	 Fall 2018 Fall 2016 Spring 2016 Fall 2015
INVITED WORKSHOP AND MEETING PARTICIPATION	NBER Spring Meetings (Race and Stratification)	March 2023
	NBER Summer Institute (Crime, Education, Gender in the Economy, and Labor Studies)	July 2022
	NBER Research Spring Meetings (Race and Stratification)	April 2022
	NBER Fall Meetings (Education and Labor Studies)	Fall 2021
	NBER Summer Institute (Education and Labor Studies)	July 2021
	NBER Spring Meetings (Race and Stratification)	April 2021
	CSMGEP Small Group Breakfast Meeting for Under-Represented Minorities (applied and accepted)	January 2021
	NBER Summer Institute (Education, Crime, and Labor Studies)	July 2020
	NBER Summer Institute (Labor Studies)	July 2019
	NBER Summer Institute (Behavioral Macro, Education, and Public Economics)	July 2018
	Spring School in Behavioral Economics, University of California, San Diego	March 2018
	6th Lindau Meeting on Economic Sciences (Lindau, Germany)	August 2017
	Meta-Analysis Psychology Summer Workshop, Texas A&M University	May 2017
	Barcelona BESLab Experimental Economics Summer School in Macroeconomics	July 2016

	The International Foundation for Research in Experimental Economics (IFREE) 21st Annual Visiting Graduate Student Workshop in Experimental Economics	January 2016
	AEA Summer Training Program, University of New Mexico	Summer 2012
SEMINARS ORGANIZED	Discrimination and Disparities (with Olga Stoddard and Barbara Biasi, formerly with Olga Stoddard and Jen Doleac)	September 2020 – May 2021
OTHER SERVICE	*Guest Lectures*	
	Policy Pubinar, Florida State University "Equal Opportunities?: Discrimination in the Workplace and Marketplace"	October 2021
	Labor Economics, Pennsylvania State University "The (Perceived) Cost of Being Female: An Experimental Investigation of Strategic Responses to Discrimination"	November 2020
	Research Methods, AEA Summer Program, Michigan State University "Introduction to Experimental Economics"	July 2020
	Research Methods, AEA Summer Program, Michigan State University "Introduction to Experimental Economics"	July 2017
	Research Methods, AEA Summer Program, Michigan State University "Introduction to Experimental Economics"	July 2016
	Guest Panelist	
	The Women in Economics (WiE) Career Chat on PhD Choice & Application	November 2021
	Honors Thesis Committee Margaret Copello (Spring 2021 – Fall 2021)	
	Preparing Future Faculty (PFF) Program Mentor Muazzam Toshmatova (Fall 2022)	
	Student Letters of Recommendation Fall 2021: 1, Summer 2021: 2, Spring 2021: 7, Fall 2020: 2, Fall 2019: 1, Before Fall 2019: 4	
	Proposal Reviewer J-PAL	

REFEREE EXPERIENCE

Quarterly Journal of Economics; Journal of Public Economics; Journal of Economic Behavior and Organization; Management Science; Economic Journal; Economics Letters; Journal of Health Economics; Southern Economic Journal; Games and Economic Behavior; Journal of Economics, Race, and Policy; International Review of Economics Education; Journal of Behavioral Public Administration; Journal of Business Economics; Economics of Education Review; Industrial Relations; American Law and Economic Review; Journal of Population Economics; Review of Economics of the Household

Does Black and Blue Matter? An Experimental Investigation of Race, Perceptions of Police, and Legal Compliance

Mackenzie Alston and Emily Owens*

April 18, 2023

Abstract

Increasing racial diversity among police officers is frequently posed as a way to increase the effectiveness of policing. We estimate the impact of racially representative law enforcement on people's perceptions of policing and willingness to violate the law in an experimental setting. Subjects are asked to imagine that they are driving through a real but unnamed city in the United States and are provided with demographic information about the city and its police department. They are incentivized to reach their destination quickly but have the probability of receiving a speeding ticket based on their speed and real-life ticketing practices in that city. We find that Black subjects believe there is a higher probability of punishment than White subjects regardless of the police department's racial composition. The speed chosen by White subjects is more context dependent than it is for Black subjects. White subjects drive fastest when police departments do not racially represent the population, while Black subjects choose approximately the same speeds in all conditions.

Keywords: policing, race, discrimination, experiments
JEL: K42, J15, C91

*Alston: Department of Finance, University of Illinois at Urbana-Champaign (email: mjalston@illinois.edu). Owens: Department of Criminology, Law, and Society and Department of Economics, University of California, Irvine (email: egowens@uci.edu). We thank Jesse Fan and Fernando Aguilar for excellent research assistance and Hina Usman, Jaclyn Rosenquist, and Aria Golestani for assisting with troubleshooting the experimental survey. Bocar Ba, Stanton Hudja, Steven Mello, Aurelie Ouss, CarlyWill Sloan, and conference and seminar participants also provided valuable feedback on this project.

1 Introduction

Following the shooting of Michael Brown by a Ferguson police officer in December 2014, President Obama gave 11 internationally recognized law enforcement experts 90 days to identify "best practices and [offer] recommendations on how policing practices can promote effective crime reduction while building public trust."[1] One of the central recommendations of this group, the President's Task Force on 21st Century Policing, was that the demographics of police departments should reflect the demographics of the communities they serve (Ramsey and Robinson, 2015). In general, the need for diversity in law enforcement is viewed as self-evident by many researchers and practitioners (e.g., Linos, 2017). There is also quasi-experimental evidence that changes in the racial composition of the police can affect rates of victimization, arrests, and use of force (e.g., McCrary, 2007; Hoekstra and Sloan, 2022; Harvey and Mattia, 2022). It is further possible that the diversity of a police department could influence individuals' willingness to break the law.

There are multiple pathways linking police demographics and individual criminal behavior, meaning that controlled laboratory experiments, which can isolate different theoretical mechanisms, can provide meaningful insight into the impact that hiring and retention policies that alter the composition of law enforcement might have. In this paper, we provide experimental evidence on the impact that such a policy change might have on one aspect of the criminal environment: people's propensity to speed. In the experiment, Black and White subjects were provided information about the demographics of a real, unnamed city in the United States and its police department. Subjects were randomly presented with one of four contexts: a majority White police department in a majority White city, a majority non-White police department in a majority White city, a majority White police department in a majority non-White city, or a majority non-White police department in a majority non-White city.

Subjects were told to imagine that they were driving through an area in this city where the

[1] See https://cops.usdoj.gov/ric/ric.php?page=detailid=COPS-P311 for the specific statement of task.

speed limit was 45 miles per hour (mph). While they were incentivized to drive quickly, they risked paying a fixed fine if they were ticketed. The exact ticketing probability was unknown to subjects, but they were told that it was based on ticketing data we had collected from the police department in that city, which included details about drivers in that city who had been ticketed for speeding, the subject's own characteristics, and their chosen speed. Subjects reported how fast they wanted to drive and their expectations of being punished. If they believed that their race, the racial composition of the police department, and the racial composition of the city were independent of the probability that they received a ticket, then their speed and their willingness to break the law (i.e., drive above the speed limit) should be the same regardless of which of the four contexts they were presented with. The same should be true for their beliefs about the probability of receiving a ticket.

We find that Black subjects chose to drive roughly 46 mph in all treatment conditions. On average, White subjects drove 49 mph, which was significantly higher than Black subjects. Moreover, White subjects' driving choices were context dependent. They drove faster in places where law enforcement was not racially representative compared to places where law enforcement was representative. As a result, racially representative police departments had overall lower rates of speeding; this was driven by the behavior of White subjects.

We can differentiate between multiple theoretical mechanisms linking subject race, police department race, and speeding: the expected probability of punishment at different speeds, preferences over uncertain monetary payoffs, and non-financial costs of police interaction. We find that Black subjects anticipated a higher probability of ticketing than White subjects at all but the fastest speeds. At the same time, we do not find consistent evidence that expectations of punishment vary across experimental conditions for Black or White subjects. We construct a simple model to predict subjects' expected utility given their speed decision, degree of risk aversion, and expected probability of receiving a ticket. Based on subjects' degree of risk aversion, and assuming a basic constant relative risk aversion (CRRA) utility function, differences in the expected financial payoff associated with speeding cannot explain

the racial gap in speed. One explanation of this finding is that our model failed to capture the non-financial costs involved with (imagining) interacting with police officers and that Black subjects expected those costs to be higher than White subjects. This gap in expected non-financial costs is largest in non-representative departments, where White subjects appear to anticipate the smallest non-financial utility loss.

In a later round of the experiment, subjects were told that they would be making a second speeding decision. They had the opportunity to decide if they wanted to drive in the city from the first round or drive in a different one. We elicited information about how much they were willing to pay to learn pieces of information about the new city and find that Black subjects were willing to pay more to learn about the new city than White subjects regardless of the type of information. Importantly, Black subjects were willing to pay 167% more than White subjects to learn about the racial composition of the police department. In addition, 12% of the Black subjects claimed to think about the race of police officers while making their speed decision, which was twice as many as White subjects.

If Black subjects are more willing to pay for information about the police department's racial composition and report thinking about police officers' race more, one would expect that they would respond to racial information about the police by changing their speed in the different conditions. However, we find little evidence that they do. One explanation is that Black subjects feel the most prepared or able to make good decisions when they have more information about the setting—known as ambiguity aversion. While this information may not affect their ultimate decision, it could affect how comfortable they feel with their choice. Therefore, they are willing to pay to be more informed and contemplate the information they receive but do not necessarily change their actions. This is, however, just one theory, which we did not a priori incorporate into our experiment. The potential difference in ambiguity aversion across race, and how it relates to policing, is an important subject of future research.[2]

[2]We acknowledge that less than 15% of our Black sample reported thinking about officer race or were willing to pay the most for this information; however, this is a much larger percentage compared to White

Our results are consistent with the findings of McCrary (2007) and Tyler (1990) in that more representative police departments are places where more people obey the law. Our novel finding is that, in contrast to the mechanisms implied by some psychological theories of legal compliance, the reduction in law breaking is driven by White drivers, who happen to report having the most trust in police and being less cognizant of the racial composition of law enforcement. Black drivers both perceived a higher expected non-financial cost of police interaction and were less responsive to variation in the context of that interaction.

By using an experiment, we can control what information is and is not shared with participants as well as choose the agents involved in our study. In addition, we can directly measure beliefs and attitudes, which is rarely possible outside of an experimental setting. Last, with observational data, researchers are typically limited to data on perceptions of police from those who came into contact with the justice system (e.g. the Police Public Contact Survey). However, with an experiment, we can observe the behavior of all participants. As the quality and availability of administrative records on policing increases, we hope that the online experimental framework presented here, which focuses on citizens' beliefs and behaviors, can continue to be used to study other topics in crime and policing.

The rest of paper proceeds as follows. Section 2 briefly reviews some of the central papers that motivate and contextualize our experiment. Section 3 more specifically models how race and perceptions of police bias can influence criminal behavior. Section 4 describes our experimental design and how it allows us to measure preferences for risky decisions and police contact. Section 5 describes the characteristics and choices made by subjects and provides evidence that randomization was successful. Section 6 presents our results, and Section 7 concludes with a discussion of the implications of the results.

subjects, who do appear to be responsive to the racial composition of the police department.

2 Background

There are many reasons why a police department's racial composition should reflect the racial composition of its jurisdiction. Commonly cited ones include improving the quality of officer interactions with civilians, improving the public's trust in the police, and increasing the police's ability to reduce crime. In this section we briefly summarize key findings from economics, and broader social science, in these three areas.

2.1 Race and Police Interactions

A growing body of research in economics has studied the extent to which police officers' interactions with civilians may depend on the officer's race and, in some cases, the race of the civilian. McCrary (2007) presents evidence that the fraction of arrestees who are Black declines after police departments are ordered to hire more Black officers. Ba et al. (2021) find that Black and Hispanic officers, along with female officers of any racial or ethnic category, resolve encounters in less punitive ways than White male officers. Hoekstra and Sloan (2022) also find evidence that Black officers are less likely to use force than White officers when responding to calls for service. Some of these patterns may be due to a comparative advantage in understanding and responding to same- versus cross-race encounters. For example, Antonovics and Knight (2009) find that the latter are more likely to result in searches. To the extent that the alignment of the racial composition of the police department with the population leads to less police intrusion into private lives without increasing the crime rate (McCrary, 2007), this suggests that such departmental changes in the racial composition of officers can increase policing efficiency.

2.2 Race and Trust in the Police

Given the frequent recurrence of high-profile incidents of police brutality in the United States, some Americans do not have complete confidence in the police. In addition, there

is a stark gap in how much Black and White Americans trust the police. A Gallup poll, conducted after George Floyd's murder by Minneapolis police officers, reports that 56% of White respondents felt very confident that their local police would treat them respectfully and courteously, while only 18% of Black respondents felt the same.[3] The Black-White gap in trust was smaller before George Floyd's murder, but the lower levels of trust that Black Americans have in the police is a persistent phenomenon.[4]

In addition to the history of high-profile cases of police mistreatment of people of color, another possible reason for the long-standing difference in trust is the relative concentration of White men working as police officers. When police departments are racially diverse, this can signal the value that this particular government agency places on people from different racial groups. That signal alone may can increase public trust in law enforcement (see Kyprianides et al., 2021*a*; Theobald and Haider-Markel, 2008; Desmond, Papachristos and Kirk, 2016). Moreover, to the extent that race is not correlated with an individual's preferences or innate suitability to be a police officer, we would not expect over- or under-representation of police officers of any particular group, in the absence of biased practices. When police officers are not racially representative and civilians believe this to be the result of biased hiring practices, they may expect that those same biases may affect how police officers interact with them.

2.3 Race and Crime

Under the standard Becker model of criminal behavior (Becker, 1968), a rational actor's decision to engage in crime is based on perceptions of the probability of punishment and the severity of punishment. As we will show in the next section, in the Becker model the relationship between the racial composition of the police force and criminal behavior is theoretically ambiguous. After identifying the different ways that expectations about treatment could affect speeding in the model, we will briefly summarize some of the relevant

[3]See https://news.gallup.com/poll/316571/black-americans-police-retain-local-presence.aspx.
[4]See https://news.gallup.com/poll/352304/black-confidence-police-recovers-2020-low.aspx.

research in economics, sociology, and law that has studied each specific channel.

3 A Simple Model of Speeding, Police, and Race

Suppose that the expected utility associated with driving at s mph for individual i is

$$E[U_i(s)] = p_i(s)Stopped^{r_i} + [1 - p_i(s)]Reward(s)^{r_i}, \tag{1}$$

where $p_i(s)$ is the probability that individual i believes they will be stopped and ticketed if they drive s mph, $Stopped^{r_i}$ is their utility associated with being stopped and ticketed by the police, and $Reward(s)^{r_i}$ is their utility associated with driving s mph and not being stopped. We allow for variation across individuals in their tolerance for risk, with i's coefficient of relative risk aversion being defined as $1 - r_i$.[5] When given the choice to drive between 0 and S mph, a rational driver will choose to drive s^* mph, where s^* satisfies

$$p'(s^*)/(r_i[1 - p_i(s^*)]) = Reward'(s^*)/[Reward(s^*) - Stopped^{r_i}]. \tag{2}$$

The left hand side of this optimality condition reflects how much increasing speed would increase the probability of detection, scaled by the individual's tolerance for risk and their expected probability of not getting punished. The right hand side captures the increased reward associated with driving a bit faster, which is scaled by the absolute expected reward minus the lost utility associated with being stopped. Intuitively, people who think that the probability of getting punished will be higher the faster they drive will choose a lower speed, ceteris paribus. Similarly, optimal speed will go up as tolerance for risk increases, people's concern about increased ticketing probability falls, and the utility loss associated with being ticketed, $Stopped^{r_i}$, declines in magnitude.

Equation 2 also clarifies how a police department's racial composition could affect a

[5]To simplify this illustrative model and make it consistent with our experiment, we are assuming a fixed financial penalty for being ticketed, which allows for a more direct interpretation of our results. However, in the United States the penalty for speeding is typically a function of how fast the driver was traveling.

driver's optimal choice of speed and highlights how the expectation of "bias" on the part of police officers could impact lawbreaking. More specifically, if Black or White drivers think that the demographics of a police department constitute a signal about the relevance of racial bias in police decisions, the impact on chosen optimal speed is theoretically ambiguous. This is because there are many plausible ways that bias might impact an officer's actions, and each of those ways has different implications for a driver's optimal speed.

If Black drivers believe their absolute probability of being ticketed, $p(.)$, is higher than White drivers, this will tend to reduce their optimal speed relative to White drivers. However, it is also possible that the racial composition of the police department leads some drivers to think they will be ticketed no matter what they do, meaning that there is a weak relationship between their speed and ticketing probability. In other words, they believe that $p'(s^*)$ is low for them and this type of biased policing would increase their optimal speed. Finally, if the police department's racial composition affects the utility loss associated with being pulled over, $Stopped^{r_i}$, then that could affect chosen speeds too. For instance, if Black drivers are more averse to being stopped by White officers than non-White officers, this relatively lower utility when stopped by a White officer will lead to lower optimal speeds in areas with a predominantly White police force.

Existing research on police bias has generally focused on one of these three mechanisms in isolation—racial differences in beliefs about the probability of being stopped, racial differences in beliefs about how speeding affects the probability of being stopped, or the expected disutility of police encounters across civilian race. We will review some of these papers in the subsections that follow. In our laboratory environment, we can test for differences in each of these three parameters across White and Black subjects.

3.1 Race and the Absolute Probability of Punishment

There is a large body of empirical evidence in support of the negative relationship between changes in the probability of detection and criminal behavior (see Nagin, 2013). Specific

examples of this include policies that increase the number of police in an area (Evans and Owens, 2007; Di Tella and Schargrodsky, 2004; Draca, Machin and Witt, 2011), expansions of forensic databases (Anker, Doleac and Landersø, 2021), and improvements in police surveillance technology (Alexandrie, 2017). This relationship has also been identified in laboratory settings, where the probability of punishment was manipulated experimentally (e.g., Harbaugh, Mocan and Visser, 2011; Laske, Saccardo and Gneezy, 2018). If different groups of people hold different beliefs about the underlying probability that the same actions will lead to police contact, then it directly follows that people who anticipate a higher probability that breaking the law will result in punishment will choose to engage in less rule-violating behavior.

To the best of our knowledge, the impact of officer race on the probability of punishment, conditional on behavior, has not been directly tested since actual criminal behavior is rarely observed by the researcher. However, some evidence suggests that Black civilians might perceive that the overall probability of punishment, $p(s)$, is relatively lower in police departments with more non-White officers. McCrary (2007) and Ba et al. (2021) present aggregate and individual-level evidence that Black officers may be less likely to arrest Black people than White officers. More generally, Antonovics and Knight (2009) present evidence that police officers are less likely to search people who share their racial identity. Therefore, if Black civilians are aware of these trends, they may believe that their chances of being punished are higher with White officers. These studies all frame the marginal searches or arrests affected by officer race as less effective at reducing crime than inframarginal police actions.

Based on these studies and our model, if Black drivers believe $p(s)$ is higher in predominantly White police departments, then we would expect Black drivers to drive slower in the places those departments patrol, ceteris paribus. By the same logic, White drivers may believe $p(s)$ is higher in police departments that are predominantly non-White. In that case, they would drive faster in places with more White officers, ceteris paribus.

3.2 Race and the Relationship Between Speed and the Probability of Punishment

The belief that the probability of being stopped by the police should go up as a driver's speed increases is related to the idea of distributive justice (i.e., $p'(s) > 0$), a central component of police legitimacy and legal compliance (Tyler and Fagan, 2008). If people expect to be treated unfairly and receive a ticket even in the absence of criminal behavior (i.e., if they anticipate a weak relationship between their speed and ticketing probability), the marginal cost of lawbreaking reduces and the probability of an individual engaging in crime increases. Iyengar (2008) presents some empirical evidence consistent with this idea, in that people who face life sentences for any felony are, on average, more likely to commit more serious offenses than those whose expected cost of punishment is an increasing function of crime severity.

Engel (2005) finds that Black drivers are more likely than White drivers to report distributive injustice during interactions with police officers, suggesting that $p'(s^*)$ may be lower for Black people. The implications of this for police personnel policy are less clear—Engel (2005) finds little evidence that perceptions of distributive justice vary by the race of the officer who the driver interacted with. Given Engel (2005) and our model, we may not observe Black or White drivers responding to non-White officers differently than White officers. However, Black drivers may drive faster than White drivers if Black drivers believe $p'(s^*)$ is lower than White drivers do, ceteris paribus.

3.3 Race and the Experience of Being Policed

Another important component of our model is *Stopped*, the cost to the subject of being stopped by police. To simplify our analysis, in our experiment the financial penalty associated with being stopped was fixed and is paid out of the subject's endowment.[6] We note

[6]This may be a departure from the real world, as Goncalves and Mello (2021) find that Black drivers may face higher financial penalties for being stopped than White drivers going similar speeds.

that there may be other, non-financial, costs associated with being stopped by police that may involve the racial identity of the driver and officer. These costs are not included in our model.

Black people may, on average, expect the experience of being stopped by a police officer to be more fraught than White people do. Text analysis of transcribed conversations between police officers and drivers have found that police use more informal and suspicious language when interacting with Black drivers (Voigt et al., 2017). In many jurisdictions, Black drivers are also more frequently stopped, searched, and subjected to force by police (Knox, Lowe and Mummolo, 2020; Hoekstra and Sloan, 2022). Consistent with this, qualitative research suggests that Black men have high levels of concern about the experience of being stopped by the police, over and above any official punishment (Pickett, Graham and Cullen, 2022; Hagan, Shedd and Payne, 2005; Brunson and Weitzer, 2009). Research on "the talk" suggests that Black and White parents prepare their children for potentially unfair police encounters in different ways. All parents emphasize the need to be alert, submissive, and passive, but Black parents frame this response as necessary to survive a potentially fatal encounter (Cintron et al., 2019). White people also may be more willing to accept official justifications for police use of force than Black people (Jefferson, Neuner and Pasek, 2021).

Overall, the importance of racial identity on experiences with the police is not a simple story. In fact, some qualitative literature suggests that the significance of racial identity can be overstated. For example, there is evidence that White people, particularly White men, also experience unfair treatment by the police, with some studies even arguing that their concern level is similar to that of Black people (Carr, Napolitano and Keating, 2007). In addition, it is possible that drivers may expect the racial composition of an area to affect their treatment as much, or more, than their own identity, with both White and Black people expecting worse treatment in neighborhoods that are predominantly Black (Brunson and Weitzer, 2009).

Existing research also points to some scope for the racial identity of police officers to

impact a civilian's expected disutility of being stopped, even in the case where the ultimate outcome of the encounter for Black and White subjects was identical—a concept related, but not identical, to the Tyler (1990) concept of procedural justice. Levin and Thomas (1997) find that both Black and White subjects are more likely to say that a video of White officers arresting a Black person represented police misconduct than when shown a video of Black officers arresting a Black person. More recently, Davies et al. (2021) find that subjects exposed to images of Black police officers are more likely to report that police officers are approachable and would treat them with respect. Black subjects, in particular, report police as less favorable when shown images of White officers. Kyprianides et al. (2021*b*) find that people (specifically unhoused people) are more likely to express a desire to cooperate with the police if the respondents reported previous interactions with an officer who shared an identity (e.g., race, ethnicity, or gender) with them.

Surveys of offenders find that those who recall interacting with a police officer of the same race were more likely to express an intent to avoid crime in the future (Baker, 2018). However, survey and qualitative data, reviewed in Bullock et al. (2017), do not universally suggest that changing the racial or ethnic composition of the police force will affect either perceptions of legitimacy or compliance, with some ethnographic studies even suggesting that Black officers are viewed with more suspicion by Black residents (Weitzer, 2000). Brunson and Gau (2015) point out that the magnitude of the impact of an individual officer's race, or even the racial makeup of a specific department, on a civilian's perception of police legitimacy may simply be too small to be consequential when situated in the broader context of race and policing in the United States.

Consequently, it is unclear if drivers will respond differently to a predominantly White police department compared to a predominantly non-White one. However, if our subjects behave consistently with the literature on Black-White differences in being stopped, then our prediction is that Black drivers will drive slower than White drivers because they have a higher disutility of being stopped. However, existing research produces contradictory predic-

tions about whether Black drivers will drive faster or slower than White drivers in different racial contexts. Our study therefore brings experimental evidence to bear on whether the current racial composition of a police force can affect beliefs about the probability of punishment and willingness to break the law.

4 Experimental Design

In the previous section, we covered three different channels through which race could affect speeding choice. Keeping these in mind, the experiment consisted of four rounds and a post-experiment survey, where all subjects were asked a series of questions asking them to reflect on their experience during the experiment. Screenshots of key parts of the experiment can be found in the Appendix, and additional screenshots are available in the Online Appendix.

4.1 Round 1: First Speeding Simulation

In this first round, we elicited subjects' realized value of s^*. Subjects were asked to imagine that they were driving five miles to a grocery store through City A in an area where the speed limit was 45 mph.[7] They then indicated how fast they wished to travel from 0 to 100 mph. They were incentivized to reach their destination quickly but risked receiving a costly ticket. More specifically, those who did not receive a ticket earned 3 experimental currency units (ECUs) multiplied by their speed. Those who did receive a ticket did not have the opportunity to earn 3 ECUs multiplied by their speed; instead, they lost 60 ECUs.[8]

Subjects were informed that the probability of them receiving a ticket would depend on their speed, their characteristics, the characteristics of City A and its police department,

[7] We conducted a pilot study where the speed limit was 35 mph and the demographics of the city were not mentioned. We later decided to increase the speed limit so that speeding might be perceived as less dangerous and included citizen demographics so that subjects did not have to guess whether the city was predominantly White.

[8] At the beginning of the experiment, subjects completed a comprehension quiz to check to see that they understood how ECUs would be converted to dollars. In return, they were given a bonus of 60 ECUs. This was in addition to their completion fee. Therefore, even if a subject did receive a ticket and were fined 60 ECUs, they never left the experiment with less than the completion fee.

ticketing information we had about real drivers in City A, and information about real drivers' tendency to speed. However, the exact probability that subjects received a ticket would never be disclosed to them. While subjects were not told which of their personal characteristics would be used to calculate the ticketing probability, they were reminded that they shared information about themselves when they created their Prolific account and were informed that we would collect information about them at the end of the experiment.[9]

We chose two cities in the United States to describe to subjects. These cities were chosen because their police departments provided us with data on speeding tickets and the racial composition of their employees. One police department was majority White, and the other was majority non-White. The populations of both cities could be truthfully described in a way that signaled it to be either majority White or majority non-White. As such, the experiment followed a 2x2 design where we manipulated the racial composition of the police department and the city (see Table 1).

In the conditions with a predominantly White police department (WPD), subjects were told that the police department was "between 55% and 65% White (non-Hispanic)." In the conditions with a non-White police department (NWPD), the officers were "between 5% and 15% White (non-Hispanic)." Subjects were also told about the race of residents in the city. In some conditions, they were told that the residents were "under 70% White (non-Hispanic)." With this, we expected subjects to believe they were driving through a predominantly White city (WC). Other subjects were told that the residents were "under 40% White (non-Hispanic)." We assumed that these subjects expected to be in a predominantly non-White city (NWC).[10] In total, there were four conditions: WPD-WC, NWPD-WC, WPD-NWC, and WPD-NWC.

[9]When users create an account on Prolific, they identify their race/ethnicity and sex along with other information like their employment status and nationality. The probability matrices used to assign tickets are in Appendix Tables A.1 and A.2.

[10]We asked subjects to guess the percentage of City A that was White (non-Hispanic) at the end of the experiment. On average, subjects believed that approximately 45% of the population was White when they were in the NWC conditions. In other words, they believed that more than half of the population was not White. Specifically, they believed that approximately 55% of the population was White if they were in the WC conditions. We did not ask subjects to guess the racial composition of the police force.

Table 1: Difference in Information Provided Across Conditions

Condition	Race of Police Department	Race of City
WPD-WC	Between 55% and 65% White (non-Hispanic)	Under 70% White (non-Hispanic)
NWPD-WC	Between 5% and 15% White (non-Hispanic)	Under 70% White (non-Hispanic)
WPD-NWC	Between 55% and 65% White (non-Hispanic)	Under 40% White (non-Hispanic)
NWPD-NWC	Between 5% and 15% White (non-Hispanic)	Under 40% White (non-Hispanic)

Note: Subjects saw other information about the city, its citizens, and its police department. Aside from the race of both the population and the police department, these pieces of information were held constant across conditions.

In total, three types of information were provided to all subjects: information about the city, people in the city, and the police department in the city.[11] Importantly, information about the citizens and police department included their gender and racial composition. Some additional information was provided so that it was not obvious that the focus of the study was police race.[12] However, aside from the racial composition of the population and the police department, every other piece of information given about the city was held constant across conditions.

Identifying the true probability that people with different racial and gender identities receive speeding tickets is beyond the scope of the study. That said, to not deceive subjects about how we were calculating ticketing probabilities, we constructed demographic-specific estimates of ticketing probabilities at different speeds using administrative data from the two police departments. We constructed linear monotonically increasing "ticketing probabilities" using the ticketing data, American Community Survey (ACS) population data, and information about speeding by gender and ethnicity from the second Strategic Highway

[11]For the first category, we told subjects about the population size, the geographic size of the city, and the average time to get to work. For the second category, subjects learned about the average household size, the percentage of the population who was 18 years old or older, the race and gender composition of the population, the percentage of the population of residents over the age of 24 who had a bachelor's degree or higher, and median household income. Information from these two categories came from the U.S. Census Bureau Quick Facts (https://www.census.gov/quickfacts/fact/table/US/PST045221). For the last category, subjects were told the size, gender composition, and racial composition of the police department. These data were collected from the police departments themselves.

[12]In our post-experiment survey, fewer than 2% of subjects (1.9% of Black subjects) guessed that this was an experiment about racial bias in policing. The most common belief (shared by 35% of subjects) was that this was an experiment about risk-taking.

Research Program (SHRP 2) Naturalistic Driving Study. Note that the SHRP 2 does not collect information on race (more details on the SHRP 2 and how we assigned tickets in a probabilistic way can be found in the Appendix). Subjects were not told whether or not they received a ticket until the end of the experiment, and this was only if round 1 was randomly selected for payment.

4.2 Round 2: Ticketing Probability Belief Elicitation

In round 2, subjects reported their beliefs about the functional form of $p(s)$. We asked them to state the likelihood that they would receive a ticket if they had chosen to drive under 45 mph, 45–50 mph, 51–55 mph, 56–60 mph, 61–65 mph, 66–70 mph, and over 70 mph in City A. To incentivize their beliefs, they were told that they would be paid based on how close their guesses were to the probability that we had calculated.[13] Subjects were never told how accurate any of their individual guesses were. They were only told how much they earned from this round if it was randomly chosen as the round for payment at the end of the experiment.

4.3 Round 3: Willingness to Pay for Information About New City and Second Speeding Simulation

We used round 3 of the experiment to quantify how much subjects were willing to pay for information about the city and police department, helping us to understand what subjects felt was important to make their driving decision. Subjects were given the opportunity to choose to drive in City A again in round 3 or in a new, unnamed city, City B. Before they made their choice, they were told that one piece of information about City B could be revealed to them.

[13] We used the quadratic scoring rule to calculate these bonus payments (Brier et al., 1950). The exact equation we used to calculate these earnings, $30 ECUs - 0.003 * (TheirGuess - TheCorrectAnswer)^2 ECUs$, was revealed to subjects if they clicked a button. Otherwise, the payment scheme was described in simple terms.

Subjects started round 3 with a bonus of 24 ECUs and saw a list of 12 pieces of information about City B, which matched the type of information that they had about City A (e.g., the racial makeup of the police department). They then entered a price (p_i) between 0 and 24 ECUs that they would be willing to pay for each piece of information. Qualtrics randomly chose one piece of information and randomly set the price for this information (p_R). If $p_R \leq$ p_i, then the subject "bought" the information. The information was revealed to the subject, and p_R was deducted from the 24 ECUs they started the round with.[14] If $p_R > p_i$, then the subject did not buy the information and ended the round with the full 24 ECUs that they started with. This follows the Becker-DeGroot-Marshak mechanism (Becker, DeGroot and Marschak, 1964), which was designed to incentive people to accurately report how much they are willing to pay for an item.[15]

After Qualtrics randomly chose one piece of information, it was shared with the subject if the price was less than or equal to what they stated they were willing to pay for it. Otherwise, they received no information about City B. Subjects learned how much of the 24 ECUs they were left with. They then decided whether they wanted to drive in City A or City B in the second driving round and repeated the driving simulation task in their city of choice. Every subject earned 0 to 24 ECUs from the first part of this round, and they were paid for their speeding decision only if this round was randomly chosen.

[14]City B was identical to City A except for the racial composition of the police department. If they were in one of the WPD (NWPD) conditions in round 1, then City B had a predominantly non-White (White) police department. Note that subjects only learned about the racial composition of City B's police department if "Race of Police Department" was randomly chosen with a price point below what they were willing to pay to learn about the police department's race or if they chose City B in the next driving round.

[15]If subjects understated their willingness to pay, then they risked losing the chance to receive an item they would have found worth the price. On the other hand, if they overstated their willingness to pay, then they could end up paying for an item that they would consider overpriced. Therefore, it was in the subject's best interest to state their true willingness to pay.

4.4 Round 4: Measures of Risk Preference and Risky Loss Aversion

We elicited information on subjects' risk preferences, r, using the bomb risk elicitation task (Crosetto and Filippin, 2013). Subjects saw a grid of 10x10 boxes. They were told to imagine that a bomb was hidden inside one randomly chosen box and were asked how many boxes they wanted to open. Say that the bomb was inside box b. If the subject chose to open o boxes and $o < b$, then the bomb was not set off. In this case, they earned 3 ECUs for each box they successfully opened. If $o > b$, the bomb exploded and the subject earned 0 ECUs. A risk-neutral subject will open 50 boxes,[16] and a risk-averse (risk-loving) subject will open less (more) than 50 boxes.

We also included a measure of risky loss aversion from Gächter, Johnson and Herrmann (2021). Subjects had to decide whether to accept or reject six lotteries. For each of the lotteries, there was a coin toss. If the coin landed on heads, then the subjects lost some ECUs, and if the coin landed on tails, then they gained 50 ECUs. In the first lottery, the subjects risked losing 10 ECUs. The loss amount increased by 10 ECUs with each lottery.

For the first four lotteries, the expected value was always greater than zero (e.g., the expected value of the first lottery was 20 ECUs, and the expected value of the fourth lottery was 5 ECUs). Therefore, a risk-neutral person should accept these four lotteries. The fifth lottery had an expected value of exactly 0 (i.e., lose 50 ECUs or gain 50 ECUs), and the sixth lottery had an expected value of –5 ECUs (i.e., lose 60 ECUs or gain 50 ECUs).

Qualtrics randomly chose one of these lotteries for payment. If the subject had rejected that lottery, they earned 0 ECUs. If they had accepted that lottery, they were paid based on the realized outcome. If this round was selected for payment, the subject earned ECUs from both the bomb risk elicitation and the one randomly chosen lottery.

[16] The expected value of opening x boxes is $((100 - x)/100) * 3x + (x/100) * 0$. The derivative of this is $3 - (6x/100)$, which makes $x^* = 50$.

4.5 Post-Experimental Survey

After subjects finished round 4, they answered demographic questions and described what they were thinking about during round 1 as well as what they thought the experiment was about. In addition, they answered questions about their driving experiences, including past interactions with police officers. Many of these questions were taken from the Police-Public Contact Survey (United States Department of Justice, 2014).

We also asked questions to elicit subjects' attitudes toward the police. They rated how frequently police in their neighborhood treated people "like them" the same as others, accurately understood and applied the law, and made decisions based on facts. They evaluated these statements using a Likert scale of one (almost always) to six (almost never). They also stated how much they agreed with three statements (e.g., "the police treat everyone equally regardless of their race"). These questions were taken from Sunshine and Tyler (2003).

Finally, we asked them six questions to determine how well they remembered what happened during the experiment and one about their perception of the city's race. They earned 2 ECUs for each of the seven questions that they answered correctly.

4.6 Subject Payments

Subjects were recruited from Prolific, a platform many scientists use to find participants for their experiments (e.g., Exley and Kessler, 2022). Subjects earned 175 ECUs for completing the study and 60 ECUs for successfully answering the questions from the ECU-to-dollar conversion comprehension quiz. Qualtrics randomly chose one round for payment. Then subjects had the opportunity to earn additional ECUs based on their responses to the willingness to pay section of round 3 and the post-experimental survey. One hundred ECUs were converted to $1.00. Based on subjects from our final sample, the average payment was $3.83 and the average hourly rate was $12.78 per hour. The median completion time was 19.43 minutes.

5 Data and Balance Tests

Our experiment was hosted on Prolific.com from May 25 to July 8, 2021. Individuals located in the United States who identified themselves as either White or Black on their Prolific profiles and were between the ages of 19 and 36, inclusive, were eligible to enroll in the experiment.[17] During this time period, there were 1,629 approved submissions on Prolific. We limited our analysis to people who completed the experiment only once, to those whose reported race in the experiment matched their reported race on their Prolific profile, and to those who responded to our own demographic survey as being either male or female[18] and either Black or White.

After applying these sample restrictions, our final data set consists of 1,495 individuals. A total of 370 subjects (161 Black and 209 White) were in the White police department, White city condition, and 377 subjects (181 Black and 196 White) were in the non-White police department, White city condition. A total of 367 subjects (160 Black and 207 White) were in the White police department, non-White city condition and 381 subjects (161 Black and 220 White) were in the non-White police department, non-White city condition.

To verify that our experimental sample was ultimately balanced on observable characteristics, we estimated the following equation via ordinary least squares:

$$\text{Demo}_i = \alpha + \beta_1 NonWhiteDepartmentWhiteCity_i$$
$$+ \beta_2 WhiteDepartmentNonWhiteCity_i$$
$$+ \beta_3 WhiteDepartmentWhiteCity_i + \epsilon_i,$$

where $Demo_i$ is either a subject's age, a dummy variable for race, ethnicity, gender, birthplace (U.S. or non-U.S.), ability to legally drive in the U.S., urbanicity of childhood home, political affiliation, preferences over risk, or education level. The condition assignment of subject i is indicated by the set of dummy variables

[17] We chose those ages due to the concentration of risk-taking in young adults (Hirschi and Gottfredson, 1983), although of course drivers under 19 are the riskiest drivers by standard metrics. See https://injuryfacts.nsc.org/motor-vehicle/overview/age-of-driver/ (last accessed 10/27/2022). Because we restricted the age range of eligible participants, our results on speeding behavior may not match aggregate statistics about race and driving behavior or findings from studies like Goncalves and Mello (2021).

[18] People identifying themselves as trans men (women) were classified as male (female).

Table 2: Balance Test on Race, Ethnicity, Gender, and Age

	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC
Black	0.44	0.48	0.44	0.42
	(0.50)	(0.50)	(0.50)	(0.49)
Hispanic	0.03	0.02	0.03	0.02
	(0.18)	(0.14)	(0.17)	(0.14)
Woman	0.50	0.46	0.47	0.43*
	(0.50)	(0.50)	(0.50)	(0.50)
Age	27.84	28.00	28.23	27.77
	(4.94)	(5.12)	(4.76)	(4.82)

Note: Column 1 reports the unconditional mean for each demographic characteristic for subjects in the WPD-WC condition, with standard deviations in parentheses. For each demographic characteristic, columns 2–4 report the predicted value in the top row with the standard deviation in parentheses. Stars are used to represent the p-values comparing the unconditional mean to the predicted value. *p<0.10, **p<0.05, and ***p<0.01. Subjects were asked whether or not they identified as being of Hispanic, Latinx, or Spanish origin. If they responded yes, they were counted as Hispanic. Subjects who selected "woman" were counted as a woman regardless of whether they also selected another gender identity.

indicating condition assignment. Tables 2–5 present the unconditional mean of each demographic characteristic for subjects assigned to the WPD-WC condition and the predicted value $(\alpha + \beta_k)$ of that demographic for participants assigned to condition k. P-values reflect the difference between the unconditional and predicted means, with heteroskedasticity-robust standard errors.

As seen in Table 2, there are some moderate differences in the race and gender distribution across condition assignments, where between 42% to 48% identify as Black and 43% and 50% identify as female, but only one mean difference is statistically significant. Our sample is very balanced on age; participants in each group are approximately 28 years old, on average.

Table 3 shows that most subjects were born in the United States and were legally able to drive in the country at the time of the study. There were no statistically significant differences across conditions for these two dimensions. Subjects grew up in different environments: between 12% and 20% reported growing up in a rural area, and between 15% and 19% reported growing up in the downtown area of a big city. They were significantly less likely to be from a rural area and more likely to be from a small town or city in the NWPD-WC

Table 3: Balance Test on Background

	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC
U.S. Born	0.97	0.98	0.98	0.97
	(0.16)	(0.13)	(0.13)	(0.17)
Legal Driver in U.S.	0.85	0.86	0.83	0.85
	(0.36)	(0.35)	(0.37)	(0.35)
Grew Up in...				
Rural Area	0.20	0.12***	0.17	0.17
	(0.40)	(0.32)	(0.38)	(0.38)
Small Town or City	0.22	0.27*	0.22	0.23
	(0.41)	(0.44)	(0.42)	(0.42)
Downtown Area of Big City	0.15	0.19	0.18	0.16
	(0.36)	(0.39)	(0.38)	(0.37)
Urban, Big, or Mid-Sized City	0.01	0.02	0.02*	0.02*
	(0.07)	(0.14)	(0.14)	(0.14)

Note: Column 1 reports the unconditional mean for each demographic characteristic for subjects in the WPD-WC condition, with standard deviations in parentheses. For each demographic characteristic, columns 2–4 report the predicted value in the top row with the standard deviation in parentheses. Stars are used to represent the p-values comparing the unconditional mean to the predicted value. *p<0.10, **p<0.05, and ***p<0.01. Subjects had the option to select "other" for where they grew up; this category is not shown in the table.

condition compared to the WPD-WC condition. They were also more likely to be from an urban, big, or mid-sized city in the WPD-NWC and NWPD-NWC conditions than in the WPD-WC condition.

Table 4 focuses on subjects' political affiliations and risk preferences. More than half of our sample identified as a Democrat. Subjects in the NWPD-WC condition were significantly more likely to be Democrats and less likely to be Republicans. On average, subjects in all conditions opened 30 boxes in the bomb test and accepted a loss of 31–32 ECUs when choosing between risky lotteries. At least 80% of subjects in each condition had "normal" preferences, meaning that in round 2 they reported that the chance of getting a ticket was weakly increasing in speed.

As a group, our subjects were more educated than the average American (Table 5). Between 11% and 14% had not attended any college, compared to 27.9% of the U.S. adult population, and 22% to 26% had a master's degree, which about 14% of the U.S. adult

Table 4: Balance Test on Preferences

	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC
Democrat	0.63	0.70**	0.61	0.60
	(0.48)	(0.46)	(0.49)	(0.49)
Republican	0.18	0.14*	0.19	0.17
	(0.39)	(0.34)	(0.39)	(0.37)
Independent	0.15	0.12	0.16	0.20**
	(0.35)	(0.32)	(0.37)	(0.40)
Bombs Opened	29.82	28.96	29.59	30.04
	(20.35)	(21.13)	(20.12)	(21.43)
Biggest Loss	-30.75	-32.21	-32.03	-32.40
	(18.08)	(18.26)	(19.11)	(18.29)
Normal Preferences	0.82	0.83	0.81	0.80
	(0.39)	(0.38)	(0.39)	(0.40)

Note: Column 1 reports the unconditional mean for each demographic characteristic for subjects in the WPD-WC condition, with standard deviations in parentheses. For each demographic characteristic, columns 2–4 report the predicted value in the top row with the standard deviation in parentheses. Stars are used to represent the p-values comparing the unconditional mean to the predicted value. *p<0.10, **p<0.05, and ***p<0.01. Democrat includes any subject who selected "Democrat" or "leaning Democrat," and Republican includes any subject who selected "Republican" or "leaning Republican." Subjects had the option to choose "other," "I don't know," or "I prefer not to say" when asked about their political identity. Subjects who chose those options are not included in the table.

Table 5: Balance Test on Education Level

	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC
High School Graduate or GED	0.13	0.14	0.11	0.11
	(0.34)	(0.35)	(0.31)	(0.32)
Some College but No Degree	0.18	0.16	0.17	0.23
	(0.38)	(0.37)	(0.38)	(0.42)
Associate Degree	0.04	0.07	0.08**	0.06
	(0.20)	(0.25)	(0.27)	(0.23)
Bachelor's Degree	0.38	0.37	0.35	0.33
	(0.49)	(0.48)	(0.48)	(0.47)
Master's Degree	0.22	0.21	0.26	0.25
	(0.41)	(0.41)	(0.44)	(0.43)
Professional Degree (including DVM)	0.00	0.01	0.02**	0.01
	(0.05)	(0.10)	(0.15)	(0.11)
Doctoral Degree	0.04	0.03	0.01**	0.01**
	(0.20)	(0.16)	(0.12)	(0.11)

Note: Column 1 reports the unconditional mean for each demographic characteristic for subjects in the WPD-WC condition, with standard deviations in parentheses. For each demographic characteristic, columns 2–4 report the predicted value in the top row with the standard deviation in parentheses. Stars are used to represent the p-values comparing the unconditional mean to the predicted value. *p<0.10, **p<0.05, and ***p<0.01. Subjects had the option to select "other" when asked about their highest educational attainment (not reported in this table).

population had in 2021. Like the large fraction leaning Democrat, this may affect the generalizability of our results, but particularly for the relative number of people with bachelor's and master's degrees, education levels were balanced across treatment conditions.

Subjects reported a level of confidence in police that mirrored patterns observed in the general population.[19] Black subjects generally viewed the police as less procedurally just (rows 1–3 of Table 6) than White subjects, who were almost twice as likely to report that police treated "people like them" the same as everyone else. Black and White subjects tended to have similar views on distributive justice questions related to power (row 5), but White subjects were more likely to think the police protected their interests and that the police did not use race in their decision-making.

[19]See, for example, Gallup poll results from 2021 at https://news.gallup.com/poll/352304/black-confidence-police-recovers-2020-low.aspx, last accessed 12/2/2022.

Table 6: Procedural Justice and Distributive Justice by Race

	All	Black Subjects	White Subjects	T-Test
Agreed that police treat people like you the same as everyone else (%)	40.47	26.55	51.56	p<0.01
Agreed that police accurately understand and apply the law (%)	36.66	29.56	42.31	p<0.01
Agreed that police make decisions based upon facts (%)	32.84	26.70	37.74	p<0.01
Agreed that police treat everyone equally regardless of their race (%)	22.34	19.91	24.28	p=0.04
Disagreed that police represent values of people in power vs. people like you (%)	20.20	19.16	21.03	p=0.37
Disagreed that police don't protect your interests (%)	30.63	26.40	34.01	p<0.01
N	1,495	663	832	

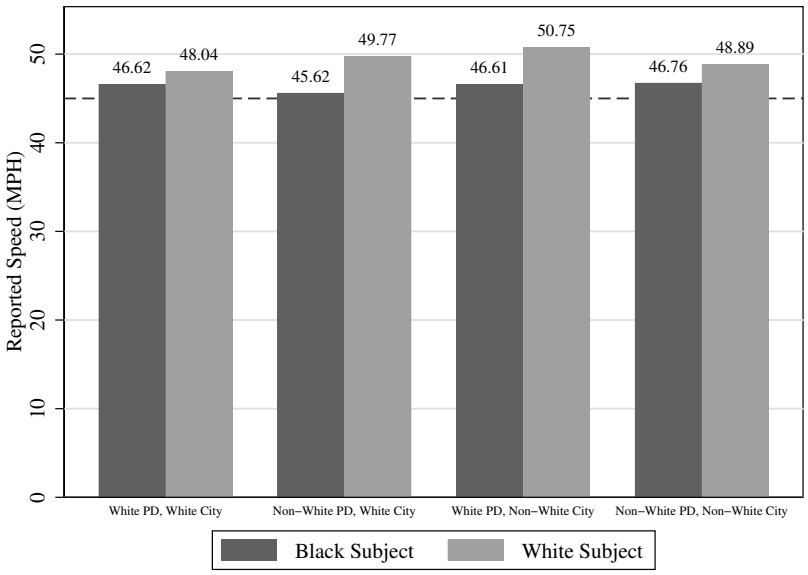
Note: These questions were taken from Sunshine and Tyler (2003). The first three items relate to procedural justice, and the last three items relate to distributive justice. The last two questions on distributive justice are reverse coded so that "strongly disagree" or "disagree" indicates a belief in distributive justice.

6 Results

6.1 Differences in Speed

In round 1, subjects could choose any speed between 0 and 100 mph. On average, they drove 48.03 mph, which is above the speed limit of 45 mph ($p(48.03 = 45)<0.01$). Figure 1 displays the average speed for Black and White subjects across the four conditions. On average, Black subjects drove slower than White subjects; while Black subjects drove 46.38 mph, White subjects drove 49.35 mph ($p<0.01$). Black subjects did not vary their speed significantly across conditions ($F=0.42$, $p=0.74$) and on average chose to stay fairly close to the speed limit. On the other hand, White subjects made different choices depending on the condition ($F=3.89$, $p=0.01$). More specifically, they chose higher speeds when the racial makeup of the city was not concordant with the racial makeup of the city's police department. For example, White subjects drove 2.7 miles per hour faster ($p<0.01$), on average, when they drove in a city with minority residents but a predominantly White police department, compared to a White city patrolled by a White department. Distributions of the reported speed by race and condition can be found in the Appendix Figures A.13–A.16.

Figure 1: Reported Speed by Condition



To analyze how subjects responded to the conditions more rigorously, we estimated the following equation using ordinary least squares: $SpeedOutcome_i = \alpha + \beta_1 Black_i + \beta_2 NWPDWC_i + \beta_3 WPDNWC_i + \beta_4 NWPDNWC_i + \beta_5 Black * NWPDWC_i + \beta_6 Black * WPDNWC + \beta_7 Black * NWPDNWC_{ii} + \epsilon_i$, where $SpeedOutcome_i$ is either the round 1 speed, a dummy variable for whether they drove under the speed limit, a dummy variable for whether they drove no faster than the speed limit, or a dummy variable for whether they drove over five miles above the speed limit.[20] We included a dummy for whether the subject is Black ($Black_i$), a dummy for three of the conditions,[21] and an interaction term for each condition and $Black_i$. These interactions tell us if the racial difference in speeding behavior varied based on the condition.

Column 1 of Table 7 shows which factors influenced how fast subjects chose to drive. Overall, there is no statistically significant difference in speed between Black and White subjects in the WPD-WC condition, and there is no significant difference in speed between the WPD-WC and NWPD-NWC for White drivers. However, similar to what we observed in Figure 1, we find evidence that White subjects drove faster in cities where the police department's racial composition was different from the racial composition of the city's population. They drove 1.80 mph faster when the police department was more diverse than the city and 2.71 mph faster when the police department was less diverse than the city relative to the WPD-WC condition. On the other hand, Black subjects drove 0.9 mph slower in the NWPD-WC condition and less than 0.1 mph faster in the WPD-NWC conditions relative to the WPD-WC. None of these differences are statistically significant. Because of this, the gaps between Black and White speeds were wider in the NWPD-WC and WPD-NWC conditions relative to the gap in the WPD-WC condition.

Column 2 shows that Black subjects were 14 percentage points more likely to drive below

[20] We chose these outcome dummies to explore the different driving approaches subjects may have taken. Some may have chosen to drive below the speed limit, which would have guaranteed that they would not receive a ticket. Anyone who chose to drive no more than 45 mph was complying with the law. A possible "rule of thumb" might be that police will only ticket people driving more than 5 miles over the speed limit. For that reason, the last outcome examines subjects who were willing to drive even faster than that.

[21] The omitted condition was WPD-WC.

Table 7: Speed in Round 1

	Speed	Drove <45 mph	Drove $\leq 45mph$	Drove >50 mph
Black	-1.36	0.14**	0.08	0.03
	(0.89)	(0.04)	(0.05)	(0.04)
NWPD-WC	1.796**	-0.06	-0.05	0.07
	(0.76)	(0.03)	(0.05)	(0.04)
WPD-NWC	2.71**	-0.06	-0.08	0.11**
	(0.85)	(0.03)	(0.05)	(0.04)
NWPD-NWC	0.82	0.03	0.04	0.01
	(0.73)	(0.04)	(0.05)	(0.04)
Black x NWPD-WC	-2.78*	0.10	0.10	-0.07
	(1.32)	(0.06)	(0.07)	(0.06)
Black x WPD-NWC	-2.69*	0.06	0.10	-0.12*
	(1.44)	(0.06)	(0.07)	(0.06)
Black x NWPD-NWC	-0.67	-0.03	-0.05	-0.03
	(1.36)	(0.06)	(0.07)	(0.06)
Constant	46.62***	0.20***	0.49***	0.15***
	(0.65)	(0.03)	(0.04)	(0.03)
N	1,495	1,495	1,495	1,495
R-squared	0.04	0.06	0.03	0.02

Note: Each regression controls for the number of boxes opened on the bomb risk elicitation task. Robust standard deviations are reported in parentheses. *p<0.10, **p<0.05, and ***p<0.001.

the speed limit than White subjects, overall, and the treatment condition did not affect the racial gap in this behavior. Column 3 shows no significant race gap in strict legal compliance, overall, nor are there any condition-specific effects.

Some drivers may believe that it is safe to drive up to 5 mph over the speed limit. For this reason, we ran a regression where the outcome was whether the subject drove above 50 mph, the results of which are in Column 4. Overall, we do not find any significant difference in speed between Black and White subjects. However, White subjects in the WPD-NWC condition were more likely to drive 5 mph over the speed limit compared to White subjects in the WPD-WC condition.

It may be surprising that Black subjects did not seem to respond strongly to the relative representativeness of the police department when White subjects did; however, this is not necessarily unprecedented in the literature. The consistency of the response of Black subjects across contexts is consistent with both Engel (2005) and Brunson and Gau (2015). While there is scant research on how White people form perceptions of police officers, we do have some evidence on how they respond to non-White authority figures in predominantly White environments. For example, ethnographic evidence from non-White teachers in White schools describes increased pushback and disobedience from White students (Rodriguez, 2009). Similarly, other qualitative studies have shown that faculty of color at predominantly White institutions report that White students often challenge them in the classroom (e.g., Stanley, 2006). In our setting, a non-White police department patrolling a White area may lead White subjects to view those police officers as less legitimate or threatening, much like how White students discredit non-White faculty.

We also conducted exploratory analyses where we examined how speeding choices varied across Black and White subjects who shared similar beliefs or had similar experiences, and the results are shown in Table 8. Our substantive findings that White subjects are more responsive to the racial composition of police departments and cities do not appear to be based on differential past experience with police officers across race; our results are qual-

itatively similar among people who reported having police contact, had experience being pulled over, or had actually received speeding tickets. The racial composition of the police and city appears to have a slightly stronger impact on the behavior of people who believed the police were unfair—particularly those who felt the police were unlikely to listen to them or make decisions in a transparent way (procedural injustice). In particular, we find that the Black-White differences in speeding were largest among people who did not believe the police were procedurally fair. People who did not think the police were distributively fair—and thus may believe that people who drive faster might not always be more likely to get a ticket—had roughly the same responses as the general sample.

Table 8: Subgroup Analysis of Speed

	Baseline	Had Police Contact	Was Pulled Over	Has 1+ Speeding Ticket	No Procedural Justice	No Distributive Fairness
Black Subject	-1.36	-1.109	0.906	0.819	-2.297**	-0.654
	(0.889)	(1.171)	(1.535)	(1.658)	(1.161)	(1.133)
NWPD-WC	1.796***	0.154	0.47	0.517	3.023**	1.673
	(0.764)	(0.696)	(0.896)	(1.085)	(1.33)	(1.018)
WPD-NWC	2.709***	1.943*	0.924	1.184	3.745***	3.148***
	(0.846)	(1.073)	(1.08)	(1.434)	(1.553)	(0.947)
NWPD-NWC	0.822	0.414	0.023	-0.391	0.214	0.420
	(0.734)	(0.837)	(1.105)	(1.242)	(1.025)	(0.779)
Black x NWPD-WC	-2.785**	-2.652	-4.428**	-3.837*	-3.582*	-3.394*
	(1.32)	(1.759)	(2.09)	(2.104)	(1.906)	(1.816)
Black x WPD-NWC	-2.693*	-1.466	-4.326*	-4.359	-1.912	-3.352*
	(1.44)	(2.004)	(2.339)	(2.683)	(2.172)	(1.820)
Black x NWPD-NWC	-0.666	-0.306	-1.01	-1.446	-.051	-1.556
	(1.356)	(1.765)	(2.461)	(2.842)	(1.831)	(1.697)
N	1,495	820	492	381	730	800
R-Squared	0.04	0.04	0.06	0.05	0.05	0.05

Note: Each regression includes a control for the number of boxes opened on the bomb risk elicitation task. The dependent variable for the first, second, third, and fourth regressions are the subject's round 1 speed, an indicator for whether they ever had police contact, an indicator for whether they have ever been pulled over, and indicator for whether they have received at least one speeding ticket, respectively. The dependent variable for the fifth regression is an indicator that equals one if the subject did not choose "very often" or "almost always" when answering any of the three items related to procedural justice. The dependent variable for the sixth regression is an indicator that equals one if the subject does not choose "agree" or "strongly agree" when asked how much they agree with any of the last two statements related to distributive justice in Table 6 and did not choose "disagree" or "strongly disagree" for the first distributive justice statement. Robust standard deviations are reported in parentheses. *p<0.10, **p<0.05, and ***p<0.001.

6.2 Differences in Expected Probabilities of Receiving a Ticket

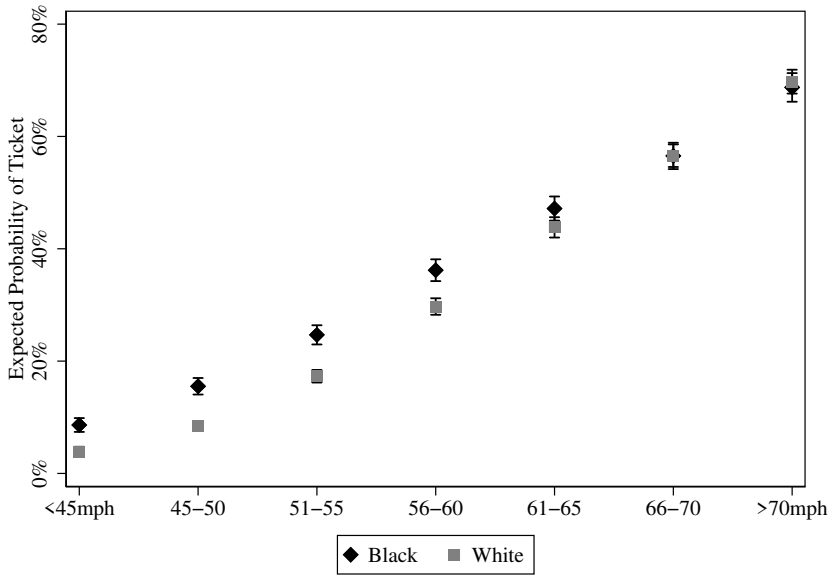
The finding that White subjects chose to drive different speeds in different treatment conditions directly supports the idea that there is increased legal compliance in places where the demographics of the police department match the patrolled jurisdiction. However, it does not tell us why these different speeds are chosen or, in particular, why White subjects chose to drive faster when the demographics of the police department did not match the area. Nor does it tell us why Black subjects were relatively unresponsive to the conditions and drove, on average, slower than White subjects. One explanation for these findings could be related to subjects' expected probability of being punished.

According to Equations 1 and 2, subjects' speed should depend on the probability that they believe that they will be stopped and ticketed and how that probability varies with speed. In round 2, we collected information about subjects' beliefs that they would receive a ticket when driving at various speeds.[22] Because of differences in personal and historical experiences with the police and perceptions of procedural and distributive justice, we hypothesized that Black subjects may have different expectations for receiving a ticket than White subjects, leading to different choices in round 1.

As shown in Figure 2, Black subjects thought there was a higher chance of receiving a ticket if they drove anywhere between 45 and 60 mph compared to White subjects. They even thought that their chances of receiving a ticket was higher than White subjects when they were driving below the speed limit. At higher speeds, the difference in beliefs across racial groups was not statistically significant (p=0.02 for 61–65 mph, p=0.98 for 66 to 70 mph and p=0.54 for above 70 mph).

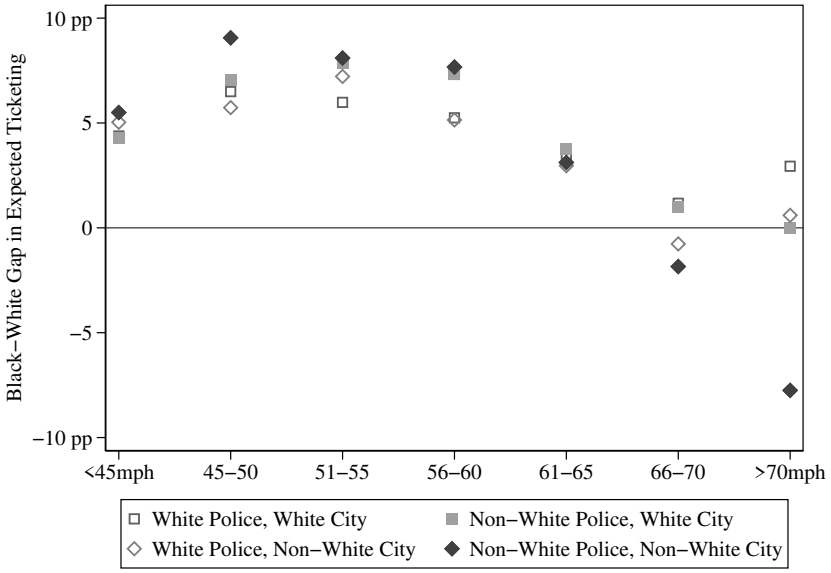
[22] In this paper, we think beliefs help to inform actions, but we acknowledge that the relationship between beliefs and actions is complicated, especially since beliefs can be formed or reported in order to internally or externally justify one's actions (Andreoni and Sanchez, 2020).

Figure 2: Expected Probability of Receiving a Ticket



While Figure 2 shows differences across race, Figure 3 shows how these racial gaps vary based on the condition. In most cases, the racial gap is similar across treatments. We observe the largest variation in beliefs about receiving a ticket across treatment conditions when driving over 70 mph. To understand this, we examined within-race differences across treatment conditions. Within race, subjects reported similar expected probabilities of ticketing across condition for speeds 70 mph and below (see Appendix Figures A.11 and A.12). At the highest speed bin (over 70 mph), White subjects believed they were most likely to get a ticket in the NWPD-NWC condition, while Black subjects believed they were most likely to get a ticket in the WPD-WC condition. This difference creates a large racial gap in "high speed" ticketing probability across conditions, seen in Figure 3.

Figure 3: Racial Gap in Expected Probability of Receiving a Ticket



To the extent that Black and White subjects held different expectations about the probability that they would receive a ticket, this would lead Black and White subjects to drive different speeds in round 1. Black subjects consistently drove slower than White subjects, and this difference is statistically significant in non-representative contexts even after controlling for differences in risk preferences. This finding could be driven by Black subjects having a higher expected ticketing probability in non-representative departments than in representative departments. Alternatively, it could be because White subjects expect to be less likely to get a ticket when departments are non-representative than when the department is representative. Further, both statements could be true. However, we do not find evidence that ticketing expectations vary by condition for Black or White subjects except at extreme speeds. Therefore, differences in probabilities alone do not fully explain our results from Section 6.1.

6.3 Differences Between Payoff-Maximizing Speed and Selected Speed

Based on Equations 1 and 2, differences in risk preferences and differences in the expected cost of being stopped and ticketed could explain our main findings. To investigate these mechanisms, we combine the elicited reports of ticketing probability and choices during the bomb risk elicitation task. Assuming that subjects have a basic CRRA utility function as described in Equation 1, with the coefficient of relative risk aversion implied by how many "boxes" they chose to open, we identified the expected utility-maximizing speed for each subject, if the only cost of being stopped by police was the cost of the ticket. In what follows, we will refer to this as the optimal or utility-maximizing speed; the assumption will always be that the cost of being stopped is only the cost of the ticket.[23] Subjects were asked to report their expected probabilities of being ticketed in 5 mph bins, so in practice they could have one of seven possible optimal speeds, corresponding with the fastest speed in each interval.[24] Out of the 1,495 subjects, 178 drove their optimal speed, implying they associated no un-modeled cost with interacting with a police officer.[25] No subject drove faster than their expected utility-maximizing speed.

The average optimal speeds for subjects, organized by subject race and treatment condition, are displayed in Table 9. In general, subjects would maximize their expected utility by driving 61 mph. Even though Black subjects generally thought that the probability of being ticketed was higher than White subjects, differences in risk aversion appear to make the optimal speeds for Black subjects slightly higher than for White subjects. The smallest difference in optimal speed across racial groups was in the White police department in

[23]We acknowledge that this is our calculated optimal speed and may not be the actual optimal speed for each subject, who may have a different utility function than what we assume.

[24]Subjects reported their beliefs about speeding in bins of 5 mph, starting at "under 45 mph" and ending at "above 70 mph." Further, they were restricted to driving from 0 mph to 100 mph. As such, the maximum optimal speeds could only be 45, 50, 55, 50, 65, 70, or 100 mph (the fastest speed someone could report).

[25]If Black and White subjects have systematically different utility functions, this will also lead to level differences, but the experimental treatment will be valid as long as the functional form of the utility function is not dependent on the expected makeup of the police force and city.

Table 9: Average Optimal Speed by Subject Race and Condition

	All	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC
All Subjects	61.28	61.24	61.39	60.85	61.65
	(20.94)	(20.77)	(21.24)	(20.81)	(21.01)
Black Subjects	62.49	61.47	62.48	61.86	64.14
	(22.11)	(20.98)	(22.07)	(21.84)	(23.58)
White Subjects	60.33	61.06	60.38	60.08	59.82
	(19.92)	(20.65)	(20.44)	(20.01)	(18.76)

Note: Means are reported for each group, and standard deviations are in parentheses.

a White city (where Black subjects should have driven 61.5 mph and White subjects 61.1 mph), and the largest difference in optimal speed occurred in non-White cities patrolled by non-White police (64.1 mph for Black subjects and 59.8 mph for White subjects).

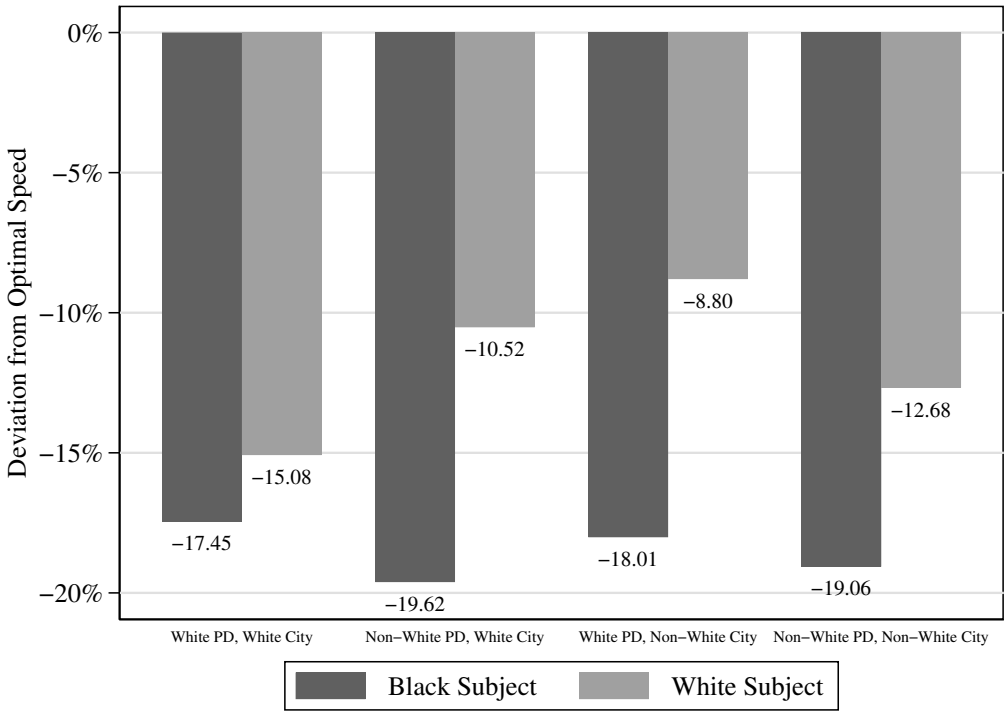
Figure 4 presents the average difference between a subject's expected utility-maximizing speed and what they actually chose, in percentage terms. In contrast to reducing observed differences across race and treatment condition, accounting for subject-specific variation in risk preferences and the expected probability of punishment increases, rather than decreases, Black-White differences in choices. That implies there is some additional factor, not included in our CRRA utility function, that drives some of the subjects' choice of speed. This additional factor can be interpreted as the non-financial cost of interacting with the police.[26] For Black subjects, this cost is relatively high and independent of the racial composition of the police department and the city. Alternatively, Black and White subjects could map speed, beliefs about being ticketed, and risks into utility in fundamentally different ways. In either case, both respond differently to the racial composition of the police force.

Black subjects chose to drive between 17% and 20% slower than optimal; as in our previous results, the behavior of Black subjects was relatively constant across treatment conditions. White subjects, in general, drove closer to their expected utility-maximizing speeds. If we assume that deviations from the optimal speed capture the non-financial costs

[26]We recognize that subjects are participating in an experiment and are not interacting with police officers in real life at that moment. However, we did encourage subjects to imagine that they were driving and would encounter the police in this hypothetical scenario. Admittedly, when we asked subjects what they were thinking of during round 1, very few mentioned a fear of the police or topics related to police brutality.

of being stopped and ticketed by the police, this implies that compared to White subjects, Black subjects perceived higher non-financial costs. White subjects expected the least costly police interactions to occur when a majority non-White city was patrolled by a White police force, and the most costly to be when a White police department patrolled a White city. The largest racial gap in deviation from "optimal" behavior occurred in treatment conditions with non-representative police departments.

Figure 4: Percentage Deviation from Optimal Speed by Condition



Note: The percentage deviation from optimal speed is based on the difference between a respondent's chosen speed and the speed that would produce their highest possible expected utility (if police interactions held no non-financial costs), based on their reported expectation of a ticket at that speed and decision in the bomb risk elicitation task. This difference is then divided by their expected utility-maximizing speed.

6.4 Subjects' Reported Thoughts and Revealed Preferences

We use two approaches to get a better sense of the non-financial variables (e.g., the emotional cost of interacting with the police) that subjects were considering when making their speeding choices. First, we asked subjects how much they were willing to pay for different pieces of information about hypothetical City B in round 3. Second, we analyzed their responses

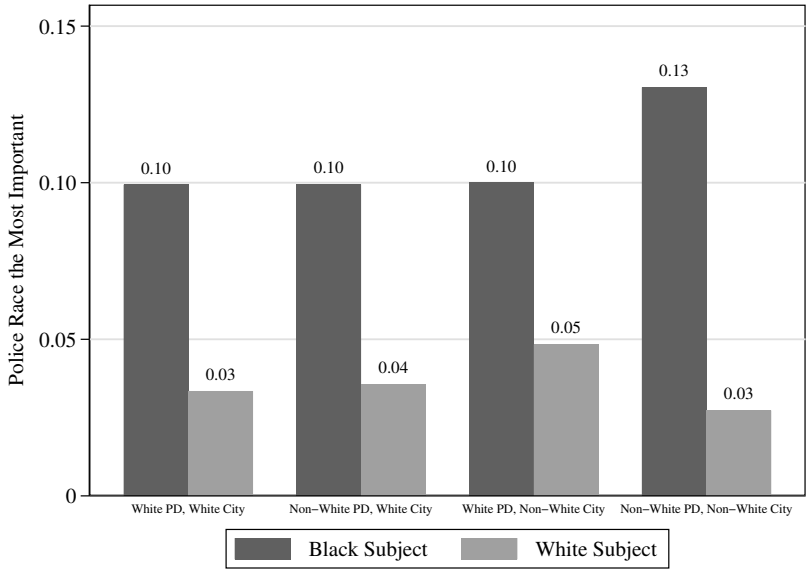
when we asked them what they were thinking about when they were making their decision about how fast to drive in round 1.[27]

Subjects' revealed preferences for information about police race are reported in Table 10. Black subjects were, in general, willing to pay more for information about City B than White subjects (see Appendix Table A.3). On average, they were willing to pay 3 ECUs more than White subjects to learn the race of a police department ($p<0.01$). However, their willingness to pay to learn about race did not vary substantively or significantly across treatment conditions ($F=0.36$, $p=0.79$). At least 10% of all Black subjects thought learning the police department's racial composition was the most valuable thing, and those initially exposed to the NWPD-NWC condition were 3% more likely to pay the most to learn about this particular city feature than those in other treatment conditions (Figure 5).[28]

[27]Two research assistants independently read and coded subjects' open-ended responses. During the start of the coding, the authors decided the final outcome when there was disagreement about coding between the research assistants. Later, the research assistants handled disagreements by discussing the issue together.

[28]We calculated the percentage of subjects who were willing to pay more to learn about the racial composition of the police department than any other piece of information about the police, the city, or its citizens. If a subject was willing to pay an equal amount to learn about the police department's racial composition and a second piece of information, they were not counted as subjects who were willing to pay the most for police racial information.

Figure 5: Fraction of Subjects Who Paid the Most for Police Racial Information



Note: We calculated the percentage of subjects who were willing to pay more to learn about the racial composition of the police department than any other piece of information about the police, the city, or its citizens. If a subject was willing to pay an equal amount to learn about the police department's racial composition and a second piece of information, they were not counted as subjects who were willing to pay the most for police racial information.

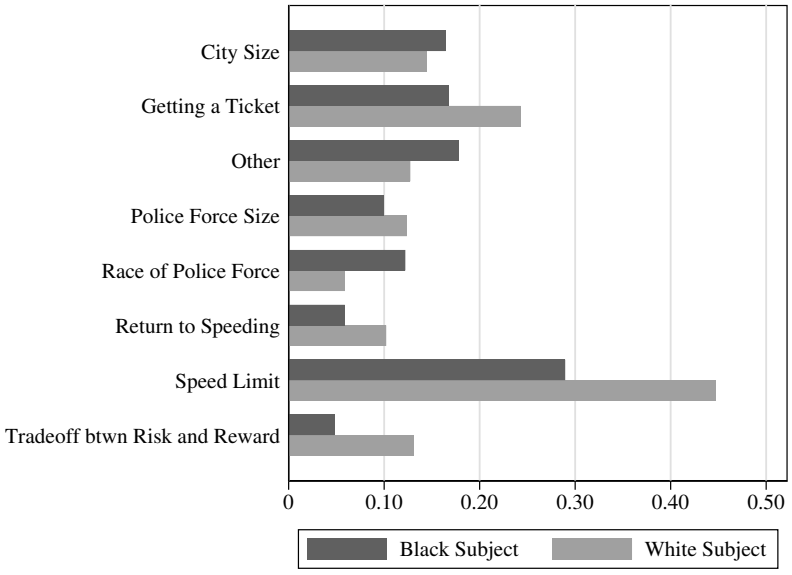
White subjects were always willing to pay less than Black subjects to learn about race but were willing to pay slightly more when initially assigned to police departments that were non-representative versus representative. As shown in Figure 5, 5% of White subjects exposed to the WPD-NWC condition and 4% exposed to the NWPD-WC condition were willing to pay the most of their ECUs to learn about department race, a 30% to 60% increase relative to the 3% exposed to the WPD-WC and NWPD-NWC condition. Both of these measures suggest that the police department's racial composition was more important to White subjects when their initially assigned department was presented as non-representative.

There is some evidence that subjects who were willing to pay the most to learn about a department's racial composition were also more sensitive to the context in which they were asked to make decisions. Limiting our sample to the 1,028 subjects who were willing to pay a positive amount to learn the police department's race yields substantively identical results to our full sample. However, focusing on the 242 subjects willing to pay more than 12 ECUs (the 75th percentile of positive values of willingness to pay) suggests that these

White subjects are even more responsive to treatment condition. We also find that Black subjects who were willing to pay at least 12 ECUs chose to drive 3.5 mph faster in White cities that were patrolled by a non-White versus White police department, suggesting that for these individuals, the expected costs of driving in a White city depended on the racial composition of the police force (full results available on request).

Our analysis of subjects' reported thoughts during round 1 allowed us to further investigate how strongly they considered the racial composition of police departments when making their speeding decisions. As seen in Figure 6, excluding the other category, the most common topics discussed were the speed limit, getting a ticket, and the size of the city for both Black and White subjects. While the racial composition of the police department appears not to be the top thought on subjects' mind, we do find that Black subjects mentioned the racial composition of the police department 12% of the time, which was twice as often as White subjects.

Figure 6: Subjects' Self-Reported Thoughts During Round 1



While self-reported, the subject's recollections of their thoughts comport with their preferences as revealed during the experiment. As Table 10 shows, the 130 subjects who reported thinking about the police department's racial composition were willing to pay twice as much

to learn about it as other subjects (10.83 versus 5.45 ECUs). There are differences in how reported thoughts are related to revealed preferences across racial groups. Relative to Black subjects who did not report thinking about the racial composition of police departments, Black subjects who did were willing to pay 4.2 ECUs more to learn about it for City B's police department. White subjects who reported thinking about racial composition were willing to pay 5.8 ECUs more than White subjects who did not have this on their minds. This is particularly striking given that White subjects were willing to pay less for information overall. Taken together, this suggests that White subjects who were conscious of police race were more behaviorally responsive to this information than Black subjects. Additional information about subjects' willingness to pay for information can be found in Appendix Table A.3.[29]

[29]While they were willing to pay more for all information about City B than White subjects, Black subjects were slightly less likely to choose to switch cities—although the cross-race differences were statistically insignificant. White subjects were slightly more likely to switch if they were originally assigned to the NWPD-NWC condition.

Table 10: Willingness to Pay for Information About Racial Composition of Police Department

	All	WPD-WC	NWPD-WC	WPD-NWC	NWPD-NWC	Thought About PD Race	Did Not Think About PD Race
All Subjects	5.92	6.00	5.60	6.45	5.64	10.83	5.45
	(6.80)	(6.92)	(6.82)	(7.01)	(6.43)	(7.10)	(6.58)
Black Subjects	7.64	7.16	7.71	7.98	7.70	11.31	7.13
	(7.22)	(7.24)	(7.16)	(7.42)	(7.12)	(7.22)	(7.08)
White Subjects	4.55	5.11	3.66	5.27	4.13	10.04	4.20
	(6.11)	(6.54)	(5.88)	(6.45)	(5.41)	(6.90)	(5.89)

Note: Mean willingness to pay in ECUs are reported for each group. Standard deviations are in parentheses.

7 Conclusion

In every civilian encounter, police officers must demonstrate the capacity to use enough force to obtain compliance and the credibility to use that coercive force in a way that is legitimate, just, and consistent with the rule of law. When considered in the context of the history of policing and racial oppression in the United States, ensuring that the racial composition of the police force reflects that of the patrolled community may be very important in helping individual officers to strike that balance. Even further, to the extent that having a police department reflect the demographic makeup of a city increases the legitimacy of the police, scholars have postulated that this increased legitimacy can simultaneously reduce crime.

In this study, we explored how changing the racial composition of a police force relative to the local city affected how Black and White subjects made decisions about violating traffic laws. We did find that, consistent with Tyler (1990), there was more compliance with speed limits when police departments and cities had similar racial compositions. This is driven by White subjects, who consistently chose to drive faster in cities when the police did not represent the community.

The effects of representation on legal compliance are modest but non-trivial. To quantify how racial representation on a police force affects legal compliance, we used our experiment to estimate a two-stage least squares model in which how fast subjects chose to drive was a function of how White (or non-White) the subjects believed the city to be, and where being assigned to a representative police department (WPD-WC or NWPD-NWC) was an instrument for beliefs about the city's racial composition.[30] Conditional on subject's risk preferences, our data suggest that a 10% increase in the representativeness of a police department is associated with a 2.5% (se = 0.09 percentage points, p<0.01) reduction in the speed at which White subjects drive. For Black subjects, the relationship between speed and representation is less obvious and implies a smaller, imprecisely estimated 1.4% (se = 2.2

[30]We re-coded subjects' beliefs about what fraction of the city was White so that if assigned to a NWPD condition, an increase in their responses meant the city looked more like the police department.

percentage points, p=0.50) increase in speed associated with a 10% increase in representativeness.

Most notably, among White subjects, a simple complier analysis (Marbach and Hangartner, 2020) suggests that White subjects' whose decision to speed was impacted by their treatment condition were willing to pay approximately 2 more ECUs for information on police race than people who always or never sped. In contrast, Black subjects whose decision to speed was affected by their treatment condition were actually willing to pay approximately 4.5 fewer ECUs than always or never takers. While highly imprecise, this is suggestive evidence that among Black subjects, interest in the police race is likely inframarginal to legal compliance but may be consequential for the legal compliance of White subjects.

Our results suggest that Black subjects expect encounters with police officers to be costly, over and above any financial penalty for unlawful behavior. In general, they reported the probability of receiving a ticket to be higher than White subjects at all but the highest speeds. Adjusting for this difference, along with each subject's risk preferences, however, still suggests that Black subjects expect substantially larger utility losses than White subjects when interacting with the police, and this does not appear to be affected by the police force's racial composition This finding is consistent with qualitative evidence (e.g., Brunson and Gau, 2015) that civilians do not necessarily expect officers of different races to treat them differently.

At the same time, while Black subjects did not change their behavior in response to changes in the racial composition of the police force, they did care and thought about it. They were willing to pay more to learn about the racial composition and were more likely to report thinking about the race of the police when choosing their speed. This desired knowledge about department race appeared to be inframarginal to their decisions about rule compliance.

Our experiment confirms that the non-financial cost of interacting with the police is higher for Black people than for White people. We also find that increased racial repre-

sentation in local police forces can lead to increased legal compliance, which was one of the expectations of the President's Task Force on 21st Century Policing when they recommended diversifying police departments. Our findings support the assertion that there is a positive social return to representative police departments. However, our they also suggest that the disproportionate utility loss that Black people expect when encountering the police is unlikely to be responsive to changes in police hiring policy. Resolving this issue is a matter for future research.

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Appendix

A Calculating Ticket Probabilities with the Second Strategic Highway Research Program

We began with data from the two city police departments, which included the race and gender of drivers who had been issued a speeding ticket by officers from that police department. We then used the American Community Survey (ACS) to determine the number of Black women, Black men, White women, and White men who resided in each city. We scaled our ACS population estimates by the probability that people in each group drove different speeds on any given trip. This probability was estimated using data from the Strategic Highway Research Program (SHRP 2) Naturalistic Driving Study.[31] We used these two values to approximate how likely Hispanic and non-Hispanic men and women were to drive 0 to more than 30 miles over the speed limit, in 5 mph intervals, during any given trip.

With all of this information, we estimated the probability that subjects would receive a ticket based on their demographics and chosen speed. Since the SHRP 2 records ethnicity, rather than race, we used Hispanic behavior for Black residents and non-Hispanic behavior for White residents. While obviously incorrect, this allowed us to accurately tell subjects that we were using demographic information in assigning ticketing probabilities. We then used these gender-race-city-specific probabilities to estimate a linear relationship between mph over the speed limit and ticketing probability and used the predicted values from that regression to determine whether or not a subject received a ticket.

[31] Beginning in 2012, study participant in six sites had their speed and location tracked, allowing the SHRP 2 researchers to determine the maximum actual speed and maximum posted speed limit during each trip. More information about the SHRP 2 Naturalistic Driving Study can be found here: https://insight.shrp2nds.us/home/index.

Table A.1: Ticketing Probabilities (%) for WPD Conditions

	Black Women	Black Men	White Women	White Men
<45 mph	0.00	0.00	0.00	0.00
45–50 mph	15.41	28.63	7.33	13.32
51–55 mph	30.83	57.26	14.66	26.65
56–60 mph	46.24	85.89	22.00	39.97
61–65 mph	66.66	99.90	29.33	53.30
66–70 mph	77.07	99.90	36.66	66.62
>70 mph	92.49	99.90	43.99	79.95

Table A.2: Ticketing Probabilities (%) for NWPD Conditions

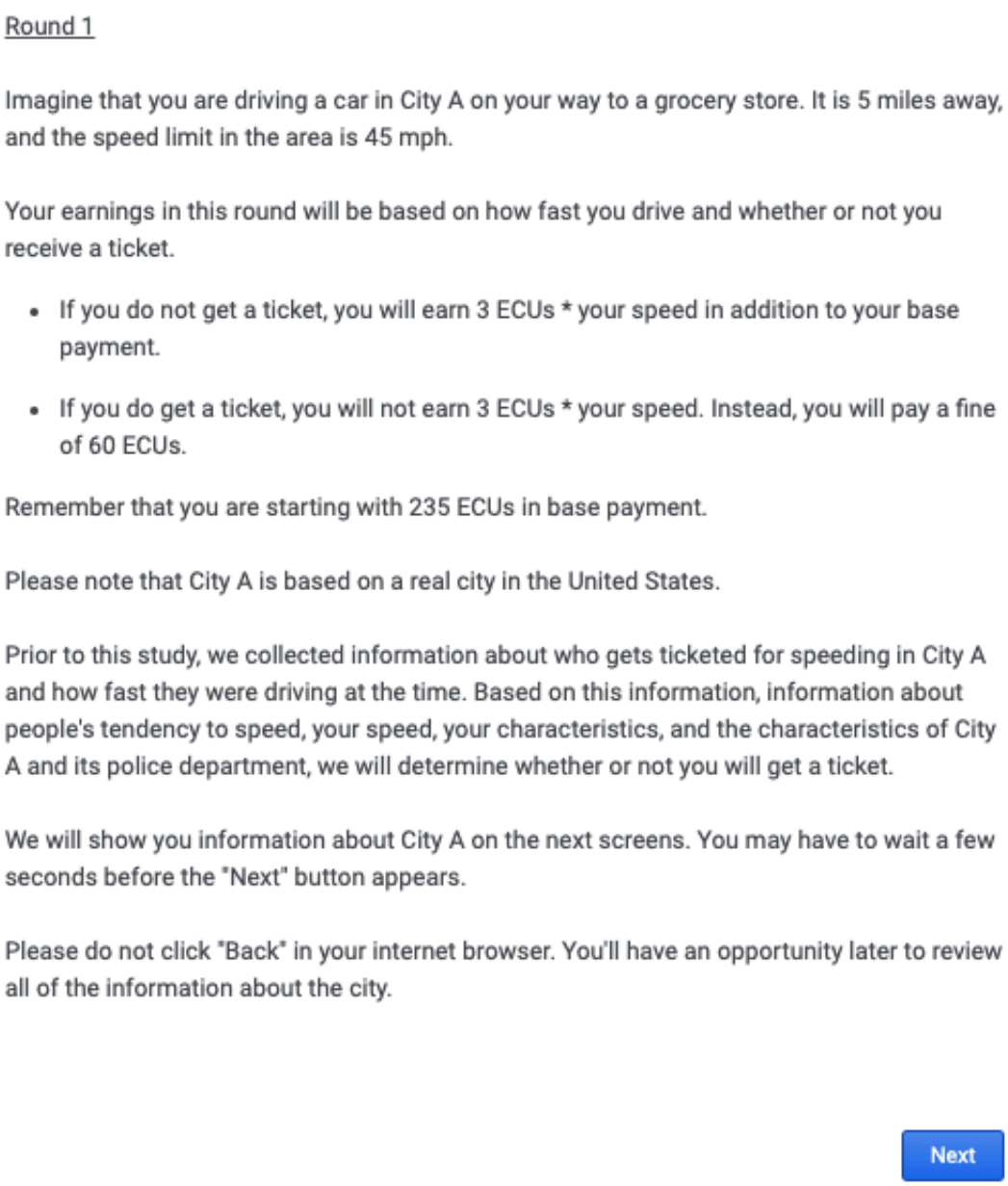
	Black Women	Black Men	White Women	White Men
<45 mph	0.00	0.00	0.00	0.00
45–50 mph	0.15	0.33	0.09	0.39
51–55 mph	0.30	0.65	0.17	0.78
56–60 mph	0.45	0.98	0.26	1.17
61–65 mph	0.60	1.30	0.35	1.56
66–70 mph	0.75	1.63	0.43	1.95
>70 mph	0.90	1.95	0.52	2.34

Table A.3: Average Willingness to Pay for Information About City B (in ECUs)

	Black Subjects	White Subjects
Population Size	5.48	4.09
Size of City	5.51	3.93
Average Time to Get to Work (For Those 16 Years Old or Older)	5.10	2.85
Average Household Size	4.03	2.07
Percent of Population Who Is 18 Years Old or Older	5.00	2.92
Gender of Population	5.36	3.01
Race of Population	7.19	5.01
Percent of Population Over 24 Years Old With Bachelor's Degree or Higher	5.21	3.41
Median Household Income	5.41	3.73
Size of Police Department	7.29	6.56
Gender of Police Department	5.89	3.95
Race of Police Department	7.64	4.55

Note: The numbers shown in the table are in ECUs. Subjects could choose to pay between 0 and 24 ECUs for each piece of information.

Figure A.1: Screenshot of Introduction to Round 1



Round 1

Imagine that you are driving a car in City A on your way to a grocery store. It is 5 miles away, and the speed limit in the area is 45 mph.

Your earnings in this round will be based on how fast you drive and whether or not you receive a ticket.

- If you do not get a ticket, you will earn 3 ECUs * your speed in addition to your base payment.
- If you do get a ticket, you will not earn 3 ECUs * your speed. Instead, you will pay a fine of 60 ECUs.

Remember that you are starting with 235 ECUs in base payment.

Please note that City A is based on a real city in the United States.

Prior to this study, we collected information about who gets ticketed for speeding in City A and how fast they were driving at the time. Based on this information, information about people's tendency to speed, your speed, your characteristics, and the characteristics of City A and its police department, we will determine whether or not you will get a ticket.

We will show you information about City A on the next screens. You may have to wait a few seconds before the "Next" button appears.

Please do not click "Back" in your internet browser. You'll have an opportunity later to review all of the information about the city.

Next

Figure A.2: Screenshot of Round 1: About the City

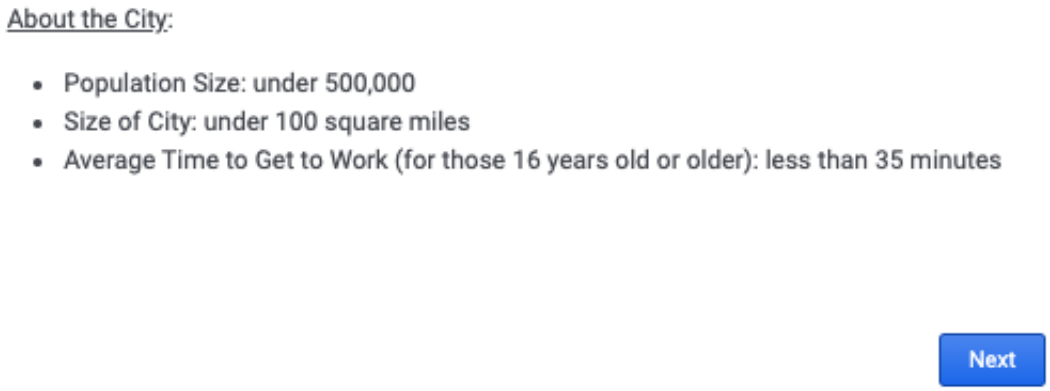


Figure A.3: Screenshot of Round 1: About the People in the City (Shown: NWC)

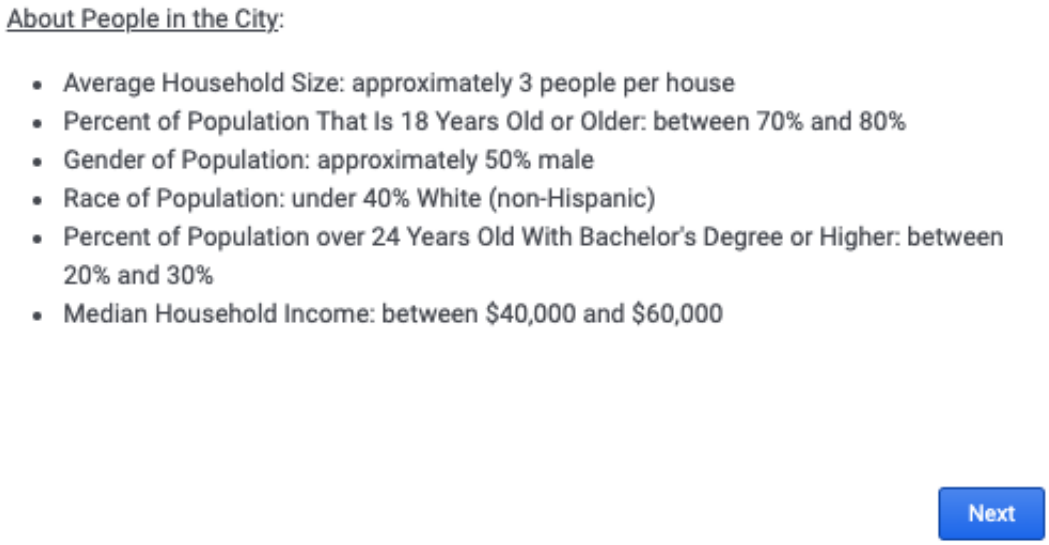


Figure A.4: Screenshot of Round 1: About the Police Department in the City (Shown: WPD)

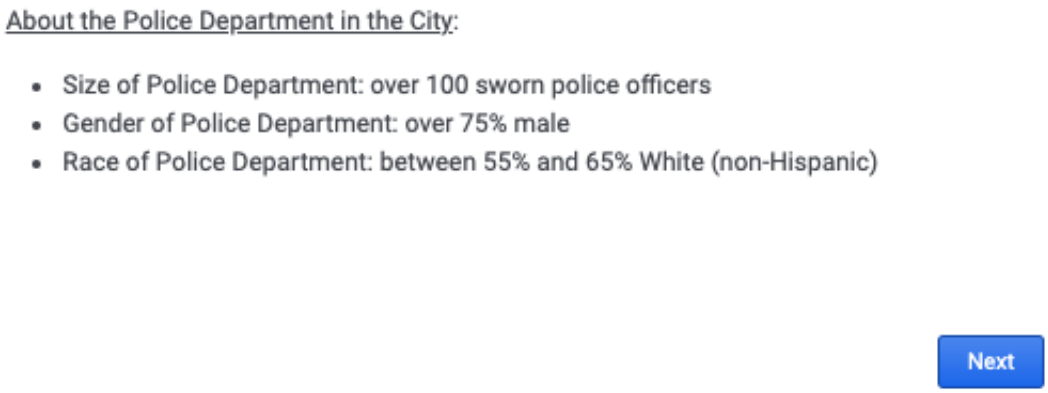
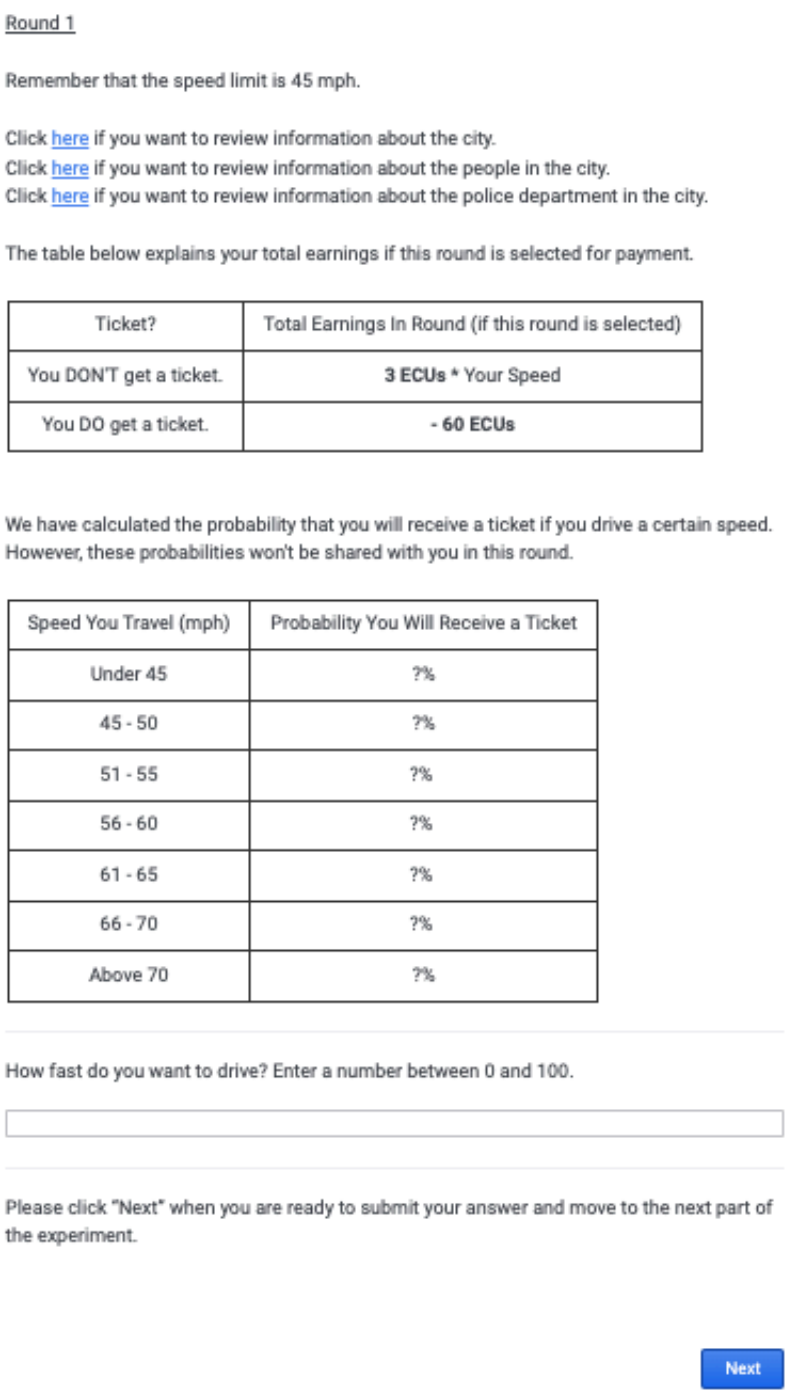


Figure A.5: Screenshot of Round 1: Speed Decision



Round 1

Remember that the speed limit is 45 mph.

Click here if you want to review information about the city.
Click here if you want to review information about the people in the city.
Click here if you want to review information about the police department in the city.

The table below explains your total earnings if this round is selected for payment.

Ticket?	Total Earnings In Round (if this round is selected)
You DON'T get a ticket.	**3 ECUs** * Your Speed
You DO get a ticket.	**- 60 ECUs**

We have calculated the probability that you will receive a ticket if you drive a certain speed. However, these probabilities won't be shared with you in this round.

Speed You Travel (mph)	Probability You Will Receive a Ticket
Under 45	?%
45 - 50	?%
51 - 55	?%
56 - 60	?%
61 - 65	?%
66 - 70	?%
Above 70	?%

How fast do you want to drive? Enter a number between 0 and 100.

Please click "Next" when you are ready to submit your answer and move to the next part of the experiment.

Next

Figure A.6: Screenshot of Round 2: Instructions

Round 2

Thank you for entering your speed!

We would now like you to tell us what you think are the chances that you would have gotten a speeding ticket in Round 1 if you had traveled at the speeds listed below.

You have the opportunity to earn bonus payments for EACH guess. The closer your guess is to the true probability, the more you will earn.

We will calculate how close each of your guesses was and pay you for each guess, so please give your best guess.

If you would like to learn more about how we will calculate your bonus payments for your guesses, click the button below.

Click Here to Learn More About How We Will Calculate Your Bonus Payments for Each Guess

How we will calculate your bonus payment for each guess:

Bonus Payment from One of Your Guess = 30 ECUs - (0.003) *[Your Guess - True Probability]^2 ECUs

Example: You say that if you had chosen to drive between 35 and 40 mph in Round 1, you think there is a 25.0% chance that you would've gotten a speeding ticket. Let's imagine that the true probability is actually 20.0%. Your bonus payment from that guess would be 29.93 ECUs.

This is because 30 ECUs - (0.003)*[25-20]^2 ECUs = 30 ECUs - (0.003)*5^2 ECUs = 30 ECUs - (0.003)*25 ECUs = 30 ECUs - 0.075 ECUs = 29.925 ECUs. When we convert this to dollars, we will round your earnings to the nearest hundredth place. In other words, we will round your earnings so that there are only two decimal places.

Figure A.7: Screenshot of Round 2: Beliefs

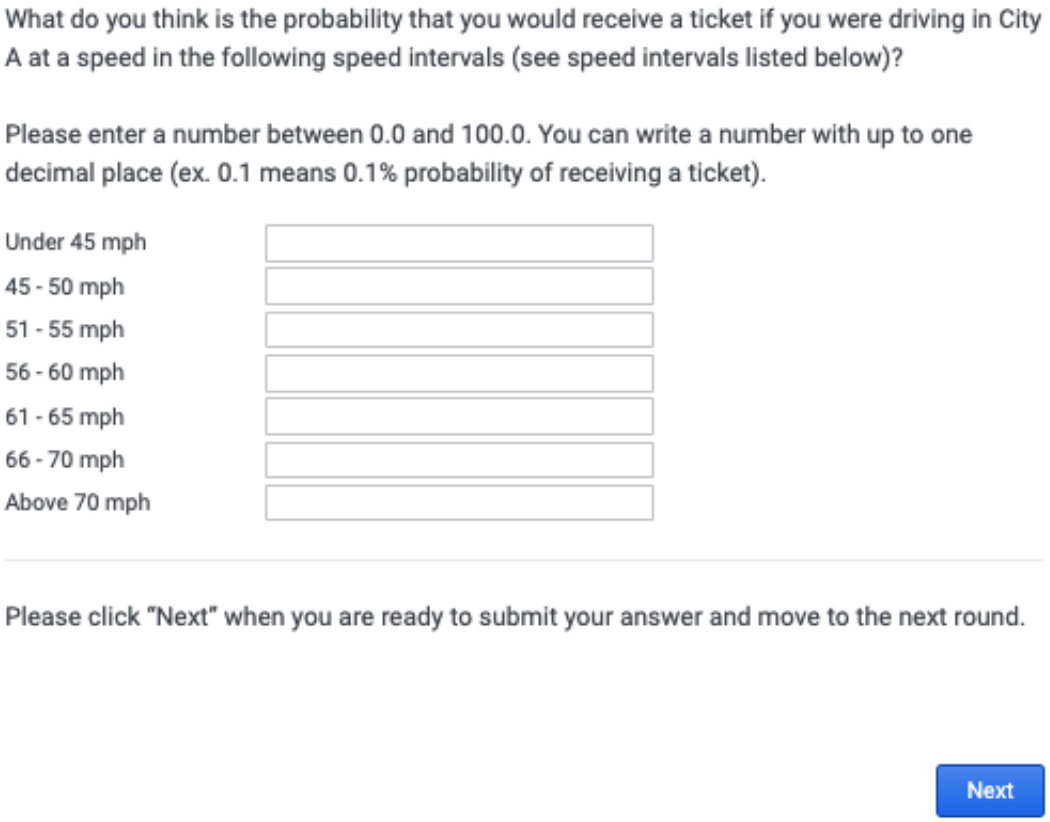


Figure A.8: Screenshot of Bomb Task

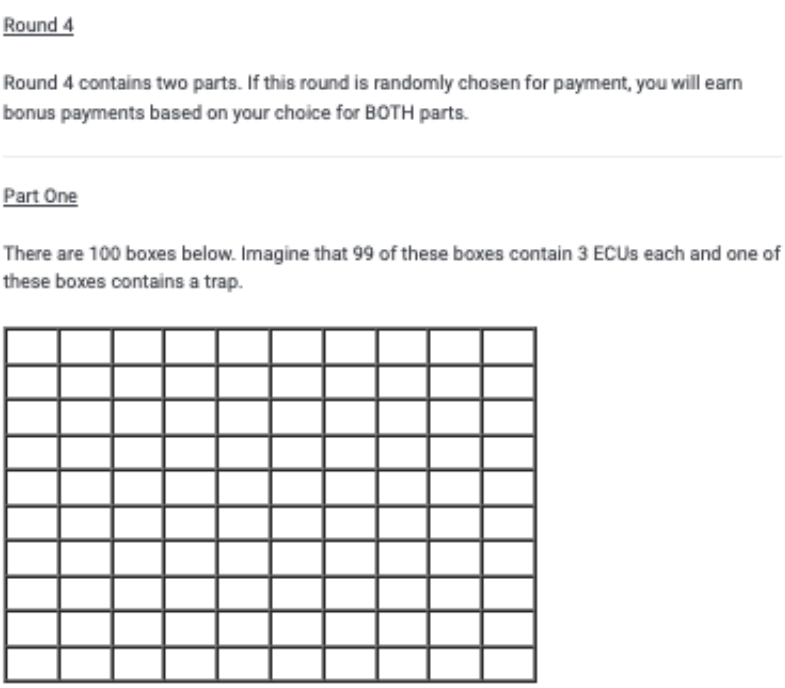


Figure A.9: Screenshot of Risky Loss Aversion

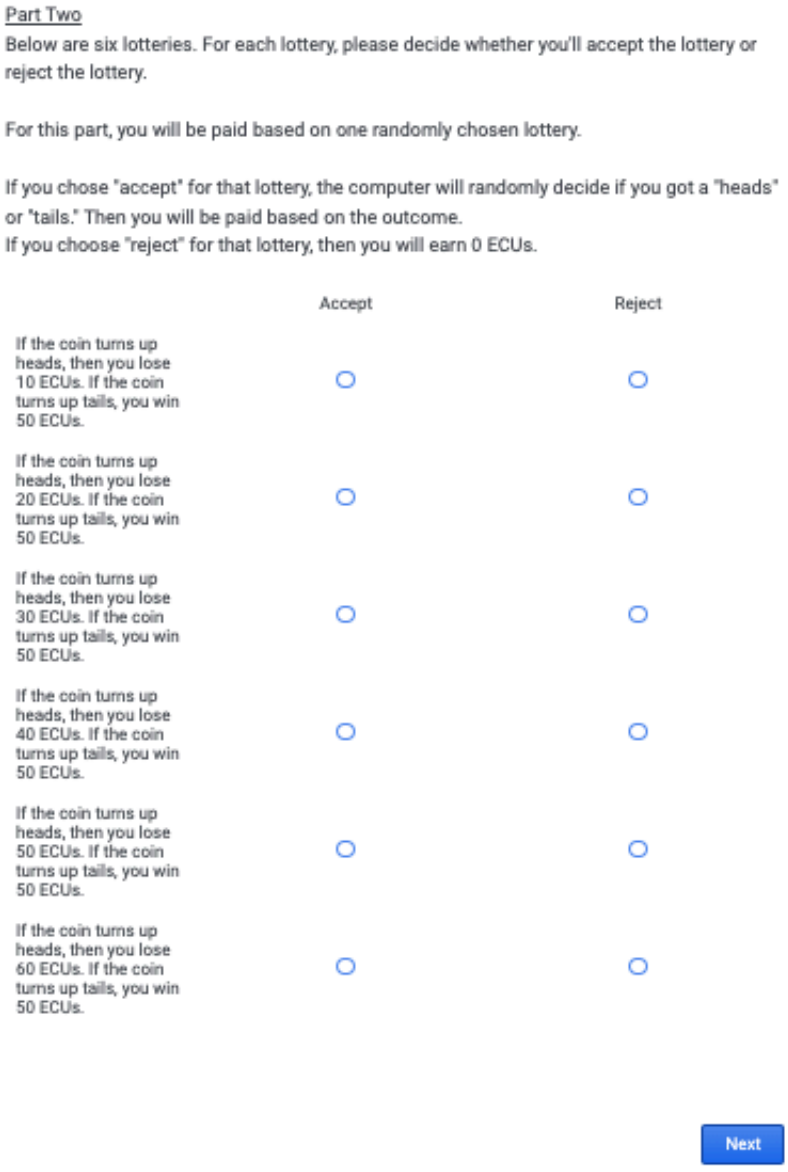


Figure A.10: Screenshot of Payment Screen (an Example)

Thank you, again, for participating in this experiment!

There were 4 rounds in this study. The computer randomly selected 1 round for payment.

Selected Round: 2

In this round, you were paid based on how correct your guesses were about the probability that you would receive a ticket.

We determined that you earned 145.13 ECUs or $1.45 based on these guesses.

You were left with 24 ECUs or $0.24 in the pre-Round 3 stage.

You also had the opportunity to earn bonus payments at the end of the experiment. You earned an additional 6 ECUs or $0.06 for correctly answering 3 of the questions at the end of the experiment.
You had a base payment of 235 ECUs or $2.35.

This brings your final payment to $4.1.
You will receive this payment within the next 14 days.

If you have any questions, please email Dr. Mackenzie Alston at malston@fsu.edu.

Submit and Return to Prolific

Figure A.11: Black Subjects' Expected Probability of Receiving a Ticket

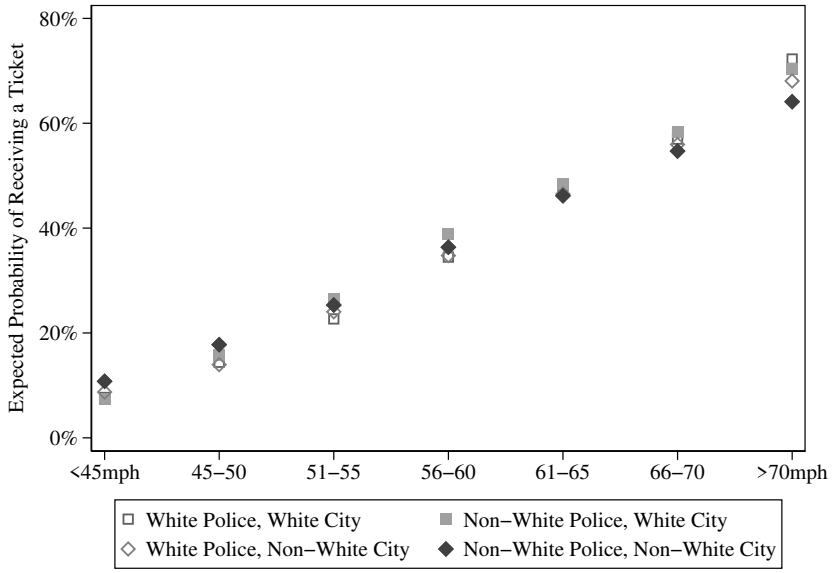


Figure A.12: White Subjects' Expected Probability of Receiving a Ticket

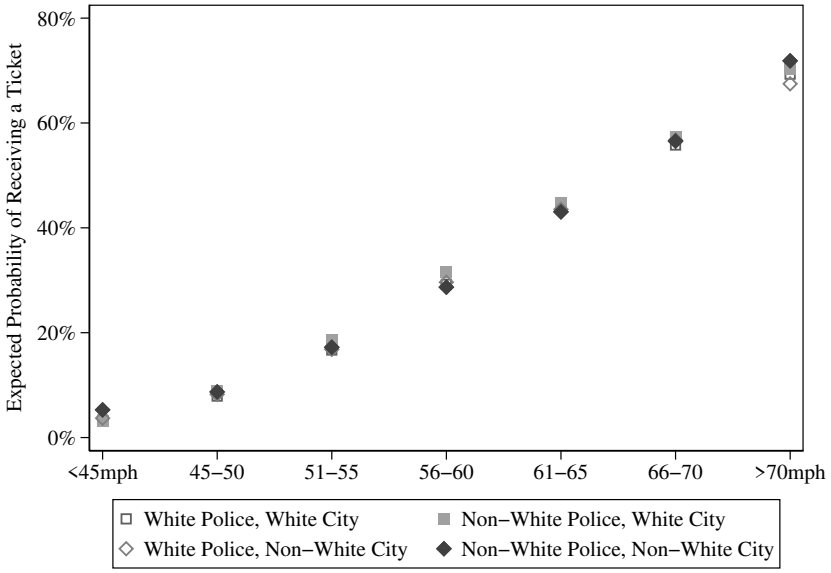


Figure A.13: Speed Distribution in White Police, White City

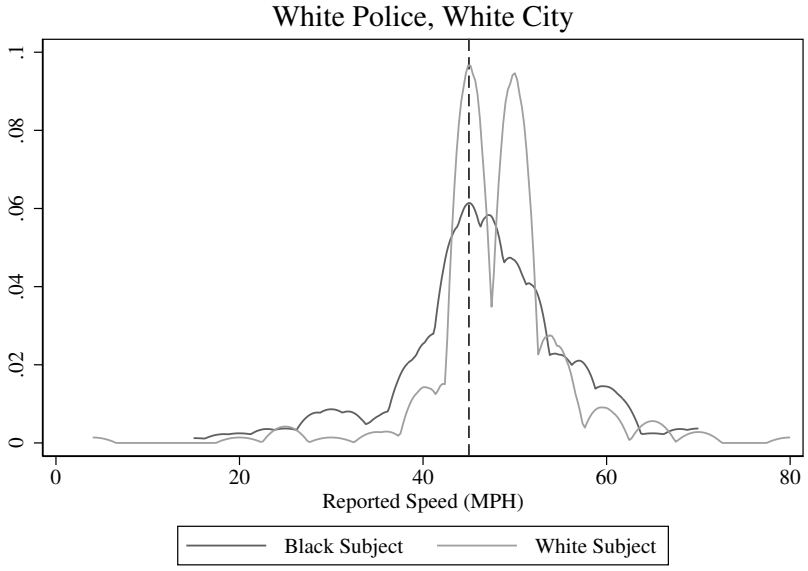


Figure A.14: Speed Distribution in Non-White Police, White City

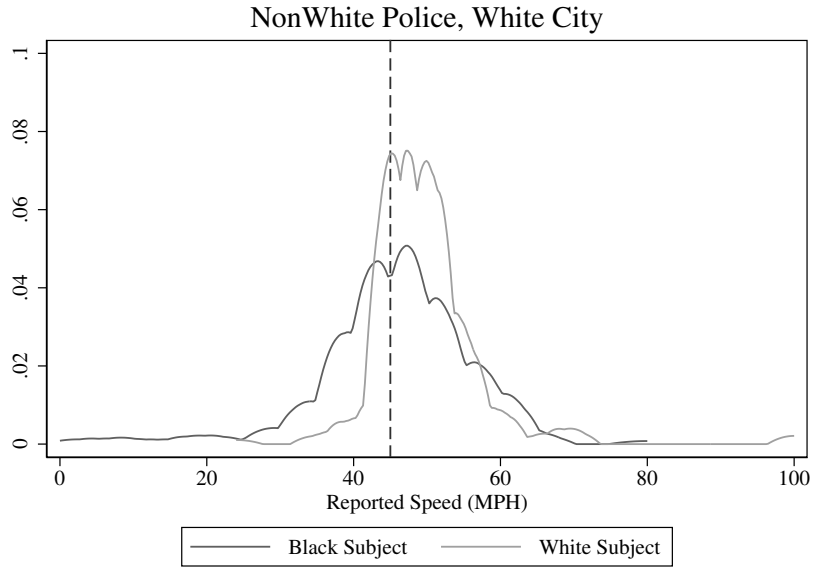


Figure A.15: Speed Distribution in White Police, Non-White City

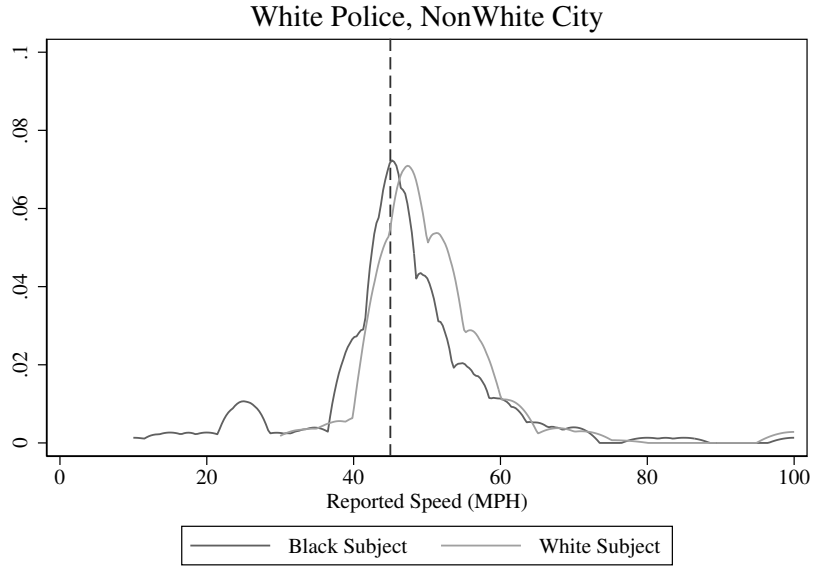


Figure A.16: Speed Distribution in Non-White Police, Non-White City

