Policy Research Working Paper 9269

Demand for "Safe Space"

Avoiding Harassment and Complying with Norms

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WORLD BANK GROUP
Development Economics
Development Impact Evaluation Group
June 2020

Policy Research Working Paper 9269

Abstract

This paper crowdsources information on ~22,000 train rides undertaken by 357 women commuters in Rio de Janeiro to study sexual harassment in the public space and its effects on demand for a women-reserved space. Women in the public space experience harassment on average once a week and randomly tasking them to ride in the reserved space reduces harassment by 50%. A revealed preference experiment shows that demand for the reserved space is heterogeneous, with top-tercile users making up 80% of the demand. These high-level users experience half of the harassment in our sample. The authors find that perceptions of norms around the reserved space may limit women's agency. Data on commuters' attitudes show over half men and women commuters associate women in the public space with more sexual openness; women who perceive this attitude to be the prevailing norm are 79% more likely to report using the reserved space.

This paper is a product of the Development Impact Evaluation Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at fkondylis@worldbank.org. A verified reproducibility package for this paper is available at http://reproducibility.worldbank.org, click **here** for direct access.

Demand for "Safe Space": Avoiding Harassment and Complying with Norms *

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Originally published in the Policy Research Working Paper Series on *June 2020*. This version is updated on *November 2022*.
To obtain the originally published version, please email prwp@worldbank.org.

Keywords: sexual harassment, gender, public transit, mobility, revealed preferences, Implicit Association Test, stigma

*This draft benefited from comments from Girija Borker, Peter Christensen, Simeon Djankov, Erica Field, Emma Frankham, Seema Jayachandran, Gabriel Kreindler, John Loeser, Shomik Mendiratta, Sveta Milusheva, Pedro Olinto, Dev Patel, Martin Raiser, Dan Rogger, three generous anonymous reviewers, and participants in seminars at ASSA 2020, Duke University, Gottingen, INSEAD, ITU, NEUDC, and the World Bank. We thank the World Bank i2i fund, the Knowledge for Change Program, the Umbrella Facility for Gender Equality, and the World Bank Brazil Country Office for generous research funding. Tuanni Borba and Rafael Dantas superbly coordinated all aspects of data collection. Finally, we thank the staff at Premise and SuperVia for their dedication in implementing this research design. This trial was registered in the 3IE database under ID-5a125fecae423 and Duke IRB D0910/2017-0401 and AEA RCT Registry AEARCTR-0006142. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. Replication package and Online Appendix are available at `https://github.com/worldbank/rio-safe-space`.

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1 Introduction

The #MeToo movement highlighted the pervasiveness of violence against women worldwide. In a survey of women in 22 countries, over 50% reported being physically harassed in public and over 70% reported being followed (Livingston, 2015). A recent literature shows that harassment and violence against women in the public space might altogether discourage women from participating in market activities (Jayachandran, 2020; Velásquez, 2019; Field and Vyborny, 2022).

Commuting to opportunity presents a specific risk for women and girls. For instance, the risk of violence on the way to school may reduce or distort women's and girls' human capital investments (Borker, 2021; Muralidharan and Prakash, 2017). Yet, the recurring nature of this harassment and the costs faced by women who *do* commute daily have not been formally documented. Moreover, there is a lack of evidence on policies capable of combating sexual harassment on public transit.

In this paper, we use high-frequency data on women commuters to study a reserved space policy on public transit in Rio de Janeiro, Brazil. In response to the increased public awareness of the high prevalence of sexual harassment in the public space, the creation of women-reserved "safe spaces" has surged.[1] This policy response is highly controversial.[2] On the one hand, advocates argue that providing women-reserved spaces allows women to avoid harassment. On the other hand, detractors make the case that, by playing into latent prejudice, these reservation policies may reinforce norms restricting women's movement in the public, non-reserved space, (*e.g., "women should not overstep their boundaries"; "to be safe, a woman should stick to her reserved space"*); if this legitimizes and increases harassment in the public space, it may be deleterious to women's safety overall. Both sides of the argument are still wanting for rigorous evidence (Aguilar et al., 2021).

[1] At the time of publication, women-reserved spaces in public transit have been adopted by cities in the Arab Republic of Egypt, Bangladesh, Belarus, Brazil, India, Indonesia, the Islamic Republic of Iran, Israel, Japan, Malaysia, Mexico, Pakistan, the Philippines, the United Arab Emirates, and the Republic of Korea, among others.

[2] See for example Guardian (2015).

We recruit 363 Brazilian women commuters to crowdsource data on ≈ 22,000 of their rides and proceed in three steps.[3] First, we show that women commuters are willing to pay to ride in the reserved space, but this demand is concentrated among a minority of riders. Second, we show that avoiding harassment partially explains women's demand for the reserved space. Riders who use the reserved space perceive a higher risk of harassment and are most likely to be harassed in the public space. Riding in the reserved space allows women to avoid harassment; other factors such as crowding and non-sexual crimes do not explain demand for the reserved space. Third, we document that commuters are likely to associate women in the public space with higher openness to sexual advances. We show that perception of this norm predicts higher demand for the reserved space among women commuters.

We start by eliciting women commuters' willingness to pay to ride in the women-reserved space. This demand is concentrated: twenty percent of riders place a positive value on accessing a women-reserved space as high as twenty percent of the transit fare. Moreover, demand is highest at times when the reservation rule is well followed, with few men in the reserved space. Demand for the reserved space does not go to zero when presence of men equalizes across the reserved and the public space, suggesting women attach a fixed-amenity value to riding in the reserved space. In addition, a third of riders make up eighty percent of the demand for the reserved space and are ten times more willing to pay for the reserved car than the rest of the sample. We show that these high-level users also perceive a higher risk of being harassed, and we show that this risk perception is associated with a higher demand for the reserved space. We use rich data on ride conditions to rule out alternative demand mechanisms such as crowding and fear of property crime.

Second, we ask: How much of women riders' valuation of the reserved space comes from a reduction in harassment vs. other amenity values women may place in the reserved space? We document the incidence of sexual harassment in the public space and the impact of

[3]The analysis dataset is available on the World Bank's Microdata Catalogue under the reference code BRA_2015-2016_DSS_v01_M (Kondylis et al., 2020)

riding in the reserved space. Randomly assigning riders either to the reserved space or the public space reveals that riders in the public space experience sexual harassment in 18 percent of rides, of which 15 percent are instances of physical harassment. This implies the average woman commuting in the public space is sexually harassed once or twice a week and physically harassed once a month. Riders assigned to the reserved space experience 50 percent lower rates of physical harassment relative to the public space. However, this harassment and protective impact of the reserved space are not uniformly distributed across our sample. In line with revealed preference estimates, the protective impact of the reserved space goes to zero when the reservation rule is not adhered to. We also find that the high level users of the reserved space experience 80 percent of the harassment reported in our sample and benefit from double the protective impact as the rest of the sample. These magnitudes are corroborated by the fact that 60 percent of riders cite avoiding harassment as the main advantage of the reserved space.

We rule out alternative explanations. We verify that riders do not systematically change their riding behavior in response to their assignment to a given space and that this assignment does not predict participation in the riding task. Crowding does not differ between the reserved and public spaces overall, and cannot explain riders' demand for the reserved space. We find that demand for the reserved space is uncorrelated with riders' concerns about non-sexual forms of crime on their commute.

We interpret our empirical results and provide a back-of-the-envelope estimate of the cost of harassment. These partial equilibrium estimates imply a low-bound individual cost of avoiding physical harassment on public transit of approximately $1.45 per incident. These costs are highly heterogeneous: relatively more vulnerable, high-level users experience an implied cost of $2.8 per incident, in contrast with $0.16 per incident for the least vulnerable. Taken at face value, this average cost estimate implies that, over a whole year, experiences of physical harassment would cost an average rider in our sample the equivalent of 0.34 percent of the minimum wage in Brazil. This is an economically meaningful tax on women's

earnings: based on estimates of the supply elasticity of women's labor in Brazil (Vick, 2017), such a wage penalty would imply a 0.4 - 0.5 percent reduction in the labor supply of a woman working at minimum wage.

Finally, we account for the possibility that bystanders may *implicitly* view women outside the reserved space as provoking harassment and assign responsibility for harassment to the victims. We interview men and women commuters on the platform and administer 948 social norm surveys and 291 Implicit Association Tests (IATs) to establish whether women face norms against riding in the public space when they have the choice of a reserved space, and whether this relates to their demand for the reserved space. Results suggest that men and women respondents both *implicitly* and *explicitly* associate women traveling in the public space with sexual provocation.

Overall, we find that a majority of men and women commuters consider using the women-reserved space as the "proper" choice for a woman commuter. Surveying women's second order beliefs reveals that women commuters who perceive this attitude against women riding in the public space to be the prevailing norm are 79 percent more likely to report taking most of their rides in the reserved space. Our back-of-the-envelope estimates suggest that complying with this perceived norm may account for more than half of the demand for riding in the reserved space.

Taken together, our results paint a nuanced picture of the impacts of women-reserved spaces. On the one hand, the incidence of harassment is lower in the reserved space than in the public space, in line with the degree of adherence to the reservation rule. However, by playing into latent prejudice, the reservation policy appears to reinforce norms limiting women's safe travel in the public, non-reserved space. We show that perception of this norm reflects back on women's demand for the reserved space, imposing an additional cost on women traveling in the public space. Quantitative estimates of this cost suggest that it is at least as large at the protective value generated by the reserved space.

This study therefore makes four central contributions to the economics literature on

crime and gender. First, we generate novel data to quantify the incidence of sexual harassment on transit.[4] While most studies focus on the prevalence of crime, getting at its incidence is essential to document the costs of a recurring, frequent crime such as public sexual harassment (Swim et al., 2001). We set up a high-frequency data generation platform and crowdsource information on experiences of harassment at the ride level. Second, we contribute to a deep literature on the economic cost of crime. We innovate by merging two strands of the literature. Closest in spirit to our methodology are studies that employ a revealed preference approach to quantify the economic cost of crime through residential sorting, housing prices, school choice, and labor supply (Cullen and Levitt, 1999; Gibbons, 2004; Linden and Rockoff, 2008; Besley and Mueller, 2012; Borker, 2021; Folke and Rickne, 2022). By generating individual variation in opportunity cost and random assignment to different spaces on the public transit, we contribute to a strand of the literature that, so far, has relied on stated preferences to establish the cost of specific criminal incidents (Cohen et al., 2004; Aguilar et al., 2021). Third, we move beyond evaluating partial equilibrium effects of reserved space policies and explore general equilibrium effects through the emergence of a norm with a dedicated IAT. This relates to a literature that has highlighted identity as a mechanism that pushes groups to comply with stereotypes in equilibrium (Akerlof and Kranton, 2000). Finally, we contribute to a literature that documents the role of social norms in limiting women's participation in market activities. For instance, family members may restrict women's mobility to safeguard their reputation of sexual "purity"; (perceived) social norms may restrict women's labor supply (Jayachandran, 2015; Field et al., 2019; Bursztyn et al., 2020; Jayachandran, 2020).

The remainder of the paper proceeds as follows. Section 2 outlines our study context. Section 3 describes our data, while Section 4 presents descriptive findings. Section 5 introduces the revealed preference results. Section 6 formally documents harassment as a mechanism

[4]In addition, while a branch of the literature considers the role of various interventions in reducing the incidence of crime against women in the public space (Banerjee et al., 2012; Iyer et al., 2012; Bisschop et al., 2017; Cunningham and Shah, 2017), these studies do not isolate an effect on sexual harassment from other types of crimes.

underlying riders' demand for the reserved space. Section 7 tests for norms against women riding in the public space as a mechanism underlying a fixed-amenity value of the reserved space. Section 8 discussed robustness to alternative mechanisms, and Section 9 concludes.

2 Study Context

We study sexual harassment on the public transit system of Rio de Janeiro, Brazil. Sexual violence on the transit system is pervasive in Brazilian cities. A recent survey in São Paulo suggests that public transport is the most common place where women suffer harassment and 35 percent of women respondents reported ever being sexually harassed while using public transport (Datafolha, 2015).

Issues of sexual harassment on the transit system have led Rio de Janeiro state government to pass legislation to reserve a space for women in its rail system. The 2006 law requires the train and metro operators to reserve one carriage in each train for women during rush hours (6-9AM and 5-8PM).[5]

Rio de Janeiro's public transit system connects many low-income families to economic opportunities: most low-income households reside in the periphery, while jobs are concentrated in the city center (Motte et al., 2016). Rio's metropolitan area has an extensive public transport system that includes bus, metro, a suburban rail, bus-rapid-transit and ferry system. Commutes are long, with a 95-minute average transit time (Moovit, 2018).

In order to capture the behavior of households living in the periphery, and for whom commuting to opportunity is particularly critical, we focus on Rio's suburban rail system, the SuperVia. This system comprises seven lines that connect downtown Rio with its outskirts, including many low-income areas. All lines radiate out of the central station, Central do Brasil (cf. Figure A1 for a map of the SuperVia network). The SuperVia carries around 700,000 passengers a day, or 10 percent of all public transport trips in the Rio metropolitan

[5]Lei N^{o} 4.733, de 23 de Março de 2006.

area. Half of SuperVia's passengers are women,[6] and one in six to eight carriages are reserved for women, depending on the train length.[7] Thus only a fraction of all women riders could ride in the reserved space at times of high congestion. Male compliance with the reservation rule is enforced by platform officers who patrol to ensure the overall safety of the boarding process without having any policing power. However, their presence varies substantially across time and stations. This foreshadows substantial differences in the *de facto* effectiveness of the reservation rule across space and time.

3 Data

We generate two main types of data.[8] First, we use a crowdsourcing app to task regular women and men commuters to repeatedly report on riding conditions. Second, we administer a platform survey and IATs on a random sample of men and women commuters. Appendix B describes the construction of the variables used in our analyses. Appendix C describes the measures the research team took to ensure the study followed ethics guidelines.

3.1 Crowdsourced Rider Experiences

Women and men riders were recruited and invited to report on their commuting experiences through a smartphone application for a monetary payment. The application allows us to vary the assigned location (reserved vs public space), pay-out, and data collection task across rides. This setup is used to 1) elicit women commuters' revealed preferences for a reserved space, and 2) introduce exogenous variation in which space to ride. These are described in Sections 5 - 6. We use the same application to task male riders with the collection of data on transit conditions throughout the network. This allows us to capture granular variation in the ride environment, independent of women riders' choice of space during their commute.

[6]Source: SuperVia administrative data.

[7]The location of the reserved cars is stable for a given train composition.

[8]The analysis dataset is available on the World Bank's Microdata Catalogue under the reference code BRA_2015-2016_DSS_v01_M (Kondylis et al., 2020).

Measures taken to ensure human subject protection over the course of this experiment are discussed in Appendix C.

Recruitment

A total of 363 women commuters and 51 men commuters were recruited to participate in the study through online social media and networks, referrals, and flyers distributed at the train stations. The recruiting material invited respondents to download a smartphone application and respond to survey questions regarding their experience with the SuperVia.[9] None of the recruitment material mentioned gender, harassment or the reserved space.

Recruitment occurred in two waves starting August 2015 and August 2016. After sign-up, riders were offered both a demographic survey task and the crowdsourcing task. Of those riders, 72.5 percent completed the demographic survey (Table A1). Riders reside along the SuperVia network all around the metropolitan area , spanning a mix of rich and poor areas (Figure A1). Women riders were offered to participate in ride tasks, while men riders were asked to collect platform observations. We now describe these two work streams.

Women riders' tasks

Each woman rider is offered a series of tasks which entail riding the SuperVia and answering questions before, during and after each ride. Data were collected between September 2015 and February 2017. Figure 1 shows how the ride task is presented in the app and broken down into three sub-tasks: check-in (*Check-in na estação*), ride either the reserved or public space (*Escolhi viajar no vagão feminino/carro comum*) and check-out (*Check-out da estação*). Total pay-out to complete a ride varies from \$4.50-\$4.70 per ride.[10,11] These rides can be completed any weekday between 6-9AM or 5-8PM (rush hour window when the reserved space policy is in effect), up to twice per day (once in the morning, once in the evening) and

[9] Our survey of a random sample of commuters indicates that 85 percent of them own a smartphone.

[10] This payment covers the SuperVia transit fare.

[11] Even though the sub-tasks are priced separately, riders must complete all three sub-tasks in the correct order to receive payment.

from any SuperVia line and station of their choice. Riders can open the app to check for available data collection tasks at any time and choose whether or not to take up the offered tasks.

The setup is used to introduce variation in payments for the use of the different spaces and document ride experiences when riders are randomly assigned to ride across the different spaces. Women riders' pipeline of tasks is divided in two phases (Figure 1 shows how these are presented in the app):

1. *Revealed preference*: Riders choose whether to ride in the reserved or public space, first at equal payoffs ($4.50; Panel (a), Figure 1), and later at differential payoffs ($4.50-$4.70; Panel (b), Figure 1) to vary the opportunity cost of riding in the reserved space. Each rider takes an average of 48 rides in this phase.[12]

2. *Random assignment to a space*: Riders are assigned tasks that specify a specific space to ride in (public or women-reserved) for a fixed payoff ($4.70; Panel (c), Figure 1). At the end of each ride, they are asked questions about their current mental state and well-being as well as any experience with harassment during their ride. We further describe these measures in section 6. Each rider takes an average of 15 rides in this phase.

Each individual is assigned an individual pipeline of specific tasks and all riders are invited to participate in both phases. Table A2 summarizes the sequence of ride types and their pay-outs. To minimize potential for gaming through strategic timing of when to ride, riders are not told the total number of rides they will be offered, or of the conditions or payment variation of future rides. A rider's take up or refusal decisions do not affect the composition of their pipeline. More details on each phase of the experiment are provided in Sections 5 - 6.

[12]To avoid framing in the revealed preference experiment, we refrain from recording riders' experiences of sexual harassment in this phase.

Several quality control measures are taken. Riders take a photograph of their check-in and check-out station. The app geo-tags and time-stamps each observation when a sub-task is started. Riders take a photo and record the car number on which they ride. The app also included checks against riders changing the time settings on their phone. The different spaces are internally connected and riders are allowed to switch spaces after reporting on the space they boarded.[13]

Riders are paid for each ride shortly after completion, and can choose to discontinue participation at any time. As a result, some riders only experimented with the application for a few rides. Table A1, panel A, shows the number of riders that progress through each of the study stages. Appendix D presents robustness checks to attrition in two forms: early attrition from the experiment and attrition (non-response) as a function of treatment assignment; we conclude that reporting through the app is unrelated to treatment assignment and, therefore, that attrition is unlikely to bias our estimates across all phases of the study.

Survey questions

We administer two short surveys through the smartphone application. An initial demographic survey includes standard questions on age, employment, education, marital status, self-assessed socioeconomic status, home location and commuting patterns (timing, lines and frequency of riding SuperVia). Once a woman rider finishes her pipeline of ride tasks, she is invited to take an exit survey, which includes questions on topics that were not included in previous interactions to avoid priming effects. It includes a set of questions on riders' stated preference as well as stated willingness to pay for the reserved space. Finally, we ask about the perceived risk of harassment across spaces, as well as the stated attitudes toward commuters using either space.[14]

[13]Upon checking out, riders are asked whether they switched spaces; they report doing so on 4-6 percent of rides across phases. We revisit this as a margin of adjustment in the results section.

[14]The complete questionnaires can be found online through this link.

Platform observations

We generate a measure of the typical conditions a rider would face on a trip at a given location and time, independent of their choice of space. Through the app we recruited and tasked men commuters to collect data on crowding and enforcement of the gender reservation policy from the platform across the entire SuperVia network. For this purpose, we divide all SuperVia lines into segments of several stations and designate half-hour blocks of the rush hour periods (6-9AM, 5-8PM). We then offered tasks such that, over a period of about three months, our platform observers collected at least three observations from each such (half-hour×line segment) combination in the direction of rush-hour traffic (i.e., in-bound in the morning, out-bound in the evening). Each task specifies where and when to collect the data. Observers stand on the platform at the designated time and place and record the percentage of male riders in both public and reserved spaces as well as the share of commuters who can sit. We impute the mean observation for each of these station-time period bins for each ride in our data.

We take two additional steps to validate these data. First, we confirm that data collected by the platform observation team are strongly correlated with what riders themselves observe on their rides (Table A3). Second, we obtain administrative data from the SuperVia as an alternative measure of crowding.[15] Figure A2 shows crowding reports from our platform observations are highly correlated with SuperVia administrative records.

3.2 Social Norm Survey and Implicit Association Tests

To measure the attitudes women face while traveling in the public space, we administer a social norm survey and IATs on a random sample of men and women commuters on the train platform. The survey includes questions on commuting behavior, stated preferences and willingness to pay to use the reserved space, perceptions about harassment and attitudes

[15]The estimates are generated by SuperVia transport planners, based on simulations and data from the station fare gates.

around women in public transit. Social norm survey questions followed the same wording as that of the rider exit survey.

Sampling

To select a representative sample of rush hour commuters, we use a simple sampling protocol based on ordering and counting individuals on the platform of each line at the main station, Central do Brasil, during the evening commute (5-8pm). Table A1, Panel B, summarizes patterns of response. A total of 1,078 commuters were approached, 555 women and 523 men. Ninety percent (90.1 percent) of women and 85.7 percent of men responded to the platform survey (Table A4 column 1), with an overall response rate of 87.9 percent.[16] We use administrative data on the number of SuperVia riders by line to apply sample weights to obtain estimates that are representative of the average rider.

After agreeing to participate in the platform survey, respondents are invited to participate in a series of IATs.[17] The IAT method and instruments are discussed in Section 4.3. Participants in the IATs are offered a compensation of R$30.00, or the equivalent of 7 hours of work at the minimum wage (about $7.50).[18] A booth was set up close to the platform and equipped with laptops on which participants took the test. The platform survey was conducted until 300 finished IATs were completed.[19] The response rate for the IATs is reported in Table A1. Conditional on being invited to take the IATs, the response rate was 40.6 percent. Women are slightly less likely to accept than men (38 percent versus 43.5 percent), but this difference is imprecisely estimated (Table A4 column 2: $p = 0.11$). Women's stated use of the reserved space is not significantly correlated with response to the IATs (Table A4,

[16] Among those who accepted to participate, 8 percent left mid-interview to board their train. See Online Appendix for the full protocol.

[17] For respondents who agree to participate in the IATs we randomize whether the platform survey is taken before or after completion of the IAT to control for priming effects differential fatigue in the instruments. We find that the order in which the respondents take either task does not affect the results (Table A5)

[18] Eighty-six platform respondents were not invited to the IATs because they were illiterate, making completion of the task, requiring matching words and pictures, impractical, and 14 were excluded due to significant disruption caused by a samba party on the train platform.

[19] Nine IATs were discarded because the system was not able to compute the results, either due to the respondent appearing to provide random answers or application failure.

column 3). Similarly, men who report that their family members usually use the reserved space are not more likely to respond to the IATs (Table A4, column 4).

IAT measures

To assess commuters' implicit attitudes toward women riding in the public and reserved spaces, we designed two IAT instruments. These instruments test the strength of association between the reserved space and safety ("Safety"), and between the public space and provocation ("Advances"), respectively. Pictures (stimuli) were taken to distinctly show the car type (women-reserved or public) but to be very similar on other characteristics, such as crowding and lighting. In the "Safety" IAT, respondents must then associate those stimuli with words connoting a greater to lesser sense of safety, such as "afraid" or "worried" versus "relaxed" or "oblivious". In the "Advances" IAT, participants were asked to sort the stimuli into categories connoting degrees of openness to sexual advances from men, such as "seductive" and "provocative", in contrast to "serious" and "saintly". The IAT results are summarized in a D-score, with a positive score suggesting a stereotypical association (reserved space with safety, public space with openness to advances). More details on the IAT methodology and how it was adapted to our study context are provided in Appendix E.[20]

4 Descriptives

4.1 Ride Environment

Trains are densely packed throughout the rush-hour period, which corresponds with the times during which the reserved space is in operation (Figure A2). We observe similar patterns across crowdsourced and administrative data. Half of the SuperVia passengers are women,[21]

[20] The Online Appendix with the full instruments is available here.

[21] This share of women riders is reported in SuperVia's operational briefs.

but only one in eight or one in six cars is designated as reserved space. Both administrative and rider audit data confirm that the reserved space is at least as crowded as the public space (Figure A2).

Observations recorded by our platform observers confirm that, even though the reserved space is designated for women only, substantial numbers of men ride in the reserved space (Figure A3). The presence of officers enforcing the policy varies substantially by station, resulting in variation in presence of male riders (Figure A4). Moreover, the cars are connected internally; it is possible for men to move from public to reserved space after boarding, further complicating enforcement. Figure A3 shows that the average proportion of men in the reserved space is 29 percent compared to 58 percent in the public space. The difference in male presence across public and reserved space at a given time and location also varies substantially (Figure A4).[22]

4.2 Riders and Their Experiences

Table 1, Panel A, shows socio-economic characteristics of the riders and platform survey respondents. Column 1 reports characteristics of our crowdsourcing app users. Most participants are regular commuters: about 70 percent are employed, and the average participant rides the SuperVia 6 times a week. Unemployed participants are the minority, but are overrepresented in the rider sample relative to the representative platform sample; this is likely because participation in the app served as a form of employment or subsidized search costs. The smartphone app also attracted a somewhat younger and more educated pool of participants than the average commuter. Stated use of the reserved space is slightly lower among crowdsourced riders than general women commuters, although both groups report taking close to half of their rides in the reserved space.

[22]In November-December 2016, we worked with the SuperVia authorities to implement an experiment to deploy enforcement staff to experimentally vary enforcement of the reservation rule. However, due to limited numbers of staff, this failed to generate sufficient variation in the presence of men in the reserved space. Therefore, we do not examine the effect of this intervention on downstream outcomes such as harassment. The data for this period are included in all our main analyses, and we include a dummy indicating being part of this pilot in all specifications. More details on the pilot are available upon request.

Riders and platform respondents both state that the risk of harassment is substantially higher in the public space: the perceived risk of either verbal or physical harassment is about twice as high in the public space as in the reserved space.

4.3 Attitudes on Harassment and Gender Segregation

To document the attitudes women face on their daily commute, we design and implement a social norm survey and a pair of Implicit Association Tests which we administer on a random sample of men and women commuters on the platform (Section 3).[23] We present a few descriptive statistics from these data to guide interpretation of our experimental results.

Stated attitudes measures

Perhaps surprisingly, the majority of men and women commuters openly blame women for inviting harassment or not doing enough to avoid it (Table A6). Most agree with at least one of the statements assigning responsibility to women for avoiding harassment or blaming them for harassment experienced in the public space. While men and women do not differ much in their attitudes, women perceive men and women's attitudes toward women riding in the public space to be quite different (Figure A5). Women are more likely to believe that men perceive women in the public space as more provocative than men are likely to report such attitude. In contrast, women's second-order beliefs about other women's attitudes match women's first-order beliefs.

Implicit attitudes measures

We find that commuters associate seeking safety more strongly with women in the reserved space than with women in the public space. They also associate being more open to sexual advances more strongly women in the public space with than with women in the reserved space. The IAT D-scores can theoretically range from -2 to +2, with zero indicating no

[23]The full instruments and details of recruitment are provided in the Online Appendix.

association in either direction. In interpreting magnitudes, we follow Greenwald et al. (2003) and use the Cohen's d benchmarks of 0.2, 0.5 and 0.8 to denote small, medium and large effect sizes. The mean D-scores on the "advances" and "safety" IAT instruments are 0.243 and 0.181, respectively; both are significantly greater than zero ($p < 0.000$).

The magnitude of our results is in line with results on traditional gender norms. For comparison, Nosek et al. (2009) find IAT D-scores for respondents' association of gender with STEM fields ranging between 0.25-0.65 in online samples across countries, and Beaman et al. (2009) report an IAT D-score of 0.11 in Indian respondents' association of gender and leadership roles. In Appendix E we show that the IAT results are not driven by more general sexism: controlling for implicit bias against women in the workplace (*gender-career* IAT) has no effect on these results.

5 Do Women Riders Value the Women-Reserved Space?

5.1 Revealed Preference Elicitation

We elicit revealed preferences from our sample of riders through our crowdsourcing app to estimate the value participants place on riding in the women-reserved space. In this setting, riders always receive a monetary compensation for reporting data about their rides. We add to this by offering a series of incentivized choices in which riders face a monetary opportunity cost for riding in the reserved space, relative to the public space.

Our design yields within-respondent variation in the choice of ride (reserved space vs public space), while retaining the simplicity and incentive compatibility of the take-it-or-leave-it single price offer method of eliciting willingness to pay (Lee et al., 2016; Ashraf et al., 2010; Cohen and Dupas, 2010). Figures 1a and 1b illustrate this choice as it was presented to riders in the app. Riders start with a series of at least 5 rides for which they are offered a \$4.50 pay-out to ride, regardless of whether they choose the public or the women-reserved space (Figure 1a). Next we introduce variation in opportunity costs for riding the reserved

space by offering a higher payment to ride in the public space. This was flagged in the app to make the price difference salient (Figure 1b).[24] Participants proceeded through a common fixed sequence of rides with varying price differentials ranging from \$0 to \$0.20, as graphed in Figure 2 and detailed in Table A2.[25] To limit framing in these first phase rides, our exit survey does not include questions on potential experiences of harassment during these rides.

5.2 Reduced-Form Results

We use data from the crowdsourcing app to estimate the effect of assigning an opportunity cost to ride in the reserved space on riders' demand for the reserved space. We then present results about key demand shifters (presence of men and risk perception). Lastly, Section 8 investigates and rules out journey planning, avoiding other crimes, sorting of perpetrators and congestion as alternative demand mechanisms.

We estimate a simple difference-in-differences specification as follows, where $d_{i,t}$ indicates that rider i was assigned a positive opportunity cost to ride in the reserved space at period t:

$$\text{Chose Reserved Space}_{i,t} = \alpha + \beta d_{i,t} + \gamma_i + \epsilon_{i,t} \tag{1}$$

In all ride-level specifications, we weigh observations by $\frac{1}{N_i}$, the inverse of the number of rides taken by the individual rider throughout the revealed preference exercise; this accounts for variation in participation frequency, which was not fully controlled by the app. Crucially in interpreting these results, we show that reporting through the app is uncorrelated to treatment assignment; hence, attrition is unlikely to bias our estimates across phases of the study (Appendix D). Zero opportunity cost rides are the omitted category. We include individual rider fixed effects γ_i, such that the effect of the opportunity cost is identified from within-rider variation across rides; as commuters have fairly rigid commuting habits,

[24] Note that, if anything, adding salience on the price difference in this case provides a conservative measure of willingness to pay for the reserved space.

[25] We randomize whether the reserved or public space option is offered on top in the app. Table A7 shows that this order does not affect the results.

this absorbs a lot of fixed variations such as commuting-route-specific presence of men or crowding. Standard errors are clustered at the rider level.

Since we do not randomize the sequencing of the opportunity cost across rides or riders and instead exploit a sharp change in pricing regime, we also estimate a flexible event study specification. For an individual rider i on ride t, we estimate the following equation:

$$\text{Chose Reserved Space}_{i,t} = \beta_{\tau_{i,t}} + \epsilon_{i,t} \tag{2}$$

Where Chose Reserved Space indicates whether the rider chose to ride in the reserved space, and where each of the event study coefficients $\beta_{\tau_{i,t}}$ is a simple difference-in-differences estimator, using the period just before the opportunity cost rides start as the "before" period (rides with zero opportunity cost), and the period of the event study coefficient as the "after" period (opportunity cost rides).

We plot the estimates from models (2) and (1) for each opportunity cost level in Figure 2, in which we restrict our sample to the sequence of rides common to all riders. The opportunity cost is displayed on the x-axis, and we estimate (1) independently at each opportunity cost level. Regression coefficient estimates from (1) are reported in Table 2, Panel A.

At zero opportunity cost, approximately 25 percent of rides are taken in the reserved space (Table 2, Panel A); about 80 percent of riders sit in the reserved space for some of their rides (Figure A6). This indicates a preference for the reserved space beyond random sorting, as only 13-17 percent of the area of a typical train is women-reserved. Introducing a positive opportunity cost for the reserved space reduces the proportion of rides taken in the reserved space by about 16.4 percentage points (Table 2). Figure A6 aggregates these estimates at the rider level: 70 percent of respondents choose the reserved space at least some of their rides when no opportunity cost is imposed, and approximately 30 percent of them continue to choose it for at least some of the the rides on which an opportunity cost is

imposed. Controlling for ride conditions (crowding and presence of men) and pooling across opportunity costs does not change the results (Columns 1 and 2, Panel A, Table 2). The results from the event study specification are similar (Figure 2). The effect remains relatively stable all through the sequence, with no evidence of time trends either in the pre- or post-periods.[26] The results across opportunity cost levels in Figure 2 and Appendix Figure A6 indicate that willingness to pay does not vary significantly across opportunity costs.[27]

5.3 Why Value the Reserved Space? Avoiding Men.

How much does presence of men in the reserved space affect riders' willingness to pay for the reserved space? We exploit variation in the presence of men in the women-reserved space to shed light on potential heterogeneity in riders' demand for the reserved space. We augment (1) by regressing the respondent's choice of the reserved space on a set of interacting dummies 1) indicating whether a positive opportunity cost was assigned at ride t, and 2) indicating whether the presence of men in the reserved space at $(time \times location)$ of ride t measured by platform observers was above or below median.[28] This yields:

$$\begin{aligned}\text{Chose Reserved Space}_{i,t} = {} & \beta_{M_1}\mathbf{1}[d_{i,t}=1] \times \text{Few Men in Reserved Space}_t \\ & + \beta_{M_2}\mathbf{1}[d_{i,t}=0] \times \text{Few Men in Reserved Space}_t \\ & + \beta_{M_3}\mathbf{1}[d_{i,t}=1] \times \text{Many Men in Reserved Space}_t \\ & + \beta_{M_4}\mathbf{1}[d_{i,t}=0] \times \text{Many Men in Reserved Space}_t + \gamma_i + \epsilon_{i,t}\end{aligned} \tag{3}$$

Equation (3) does not include a constant, and the categories are mutually exclusive and

[26] We also present results over the full sample of rides in Figure A7, Panel (a), as well as the density of observations for each ride in the sequence in Panel (b). The sample restriction does not affect our conclusions.

[27] Berry et al. (2019) also observe inelastic demand for a proven clean water technology at low ranges of the price distribution.

[28] As discussed in Section 3.1, this measure is the average of observations by third party riders traveling in the same location, day and time slot. Thus it represents the conditions that a participant can expect on her ride when she makes her decision to board the reserved or public space but does not intend to capture her own perceptions from within the train, which could be affected by her choice of car.

exhaustive. Results are reported in Panel B of Table 2. When they face no opportunity cost, riders are 6.4 percentage points more likely to choose the reserved space when the reservation rule is followed and fewer men are present in the reserved space ($\hat{\beta}_{M_2} - \hat{\beta}_{M_4}$); this represents a 30 percent increase in demand compared to the mean of 21.6 percent when there are many men in the reserved space ($p < 0.000$). The results are similar when a positive opportunity cost is imposed: ($\hat{\beta}_{M_1} - \hat{\beta}_{M_3} = 0.022, p = 0.042$), or a 30 percent increase in demand relative to the mean of 7.4 percent reserved space when there are many men in the reserved space.

5.4 Who Values the Women-Reserved Space?

We now look at the distribution of use of the reserved space across respondents. We identify "types" of respondents by dividing the sample into terciles by how frequently the respondent chooses the reserved space in the revealed-preference experiment (Figure 3). At all opportunity costs, demand for the reserved space is highly concentrated in the higher ranges of the distribution. At zero opportunity cost, the most frequent "high-level users" choose the reserved space in 46 percent of their rides relative to 19.5 percent and 3.8 percent in the second and first terciles, respectively. When a positive opportunity cost is imposed, the high-level users choose the reserved space 21 percent of the time, relative to 3.6 and 0.7 percent respectively. Overall, high-level users of the reserved space are approximately ten times more willing to pay for the reserved space than the rest of the sample, and represent over 80 percent of the total demand for the reserved space at a positive opportunity cost.[29]

Who are these women who demonstrate high demand for the reserved space? Table A8 describes participants' characteristics across terciles of the distribution of takeup of the reserved space. The main correlate is age: women under 30 are significantly more likely to demonstrate high demand for the women-reserved space. Women who take up the reserved space more tend to come from areas with *lower* crime rates. This could reflect other correlates of both variables, or perhaps self-sorting of more vulnerable or risk-averse individuals into

[29]We also replicate these results and subsequent analyses defining the terciles based on takeup of the reserved space only in zero-opportunity cost rides; the results are similar.

lower crime areas. We return to the discussion of overall crime in Section 8.2. Otherwise, there are no stark differences in observable characteristics across these groups. Notably, the respondent's self-reported socioeconomic status and the average income in her neighborhood do not predict her takeup rate.

We then investigate whether a rider's perceived risk of harassment mediates women's preference for the reserved space. In practice, we break down the results from the revealed preference rides by self-reported perceived risk of harassment. We adapt (3) to interact the assignment to a positive opportunity cost of riding in the reserved space with a rider's self-reported risk perception. The results are reported in Panels A and B, Table A9. The bottom panel reports statistical tests of coefficient equality across the assignment to positive or zero opportunity cost and a rider's level of risk perception. Women who are most concerned about physical or verbal forms of sexual harassment are 26-34 percent (6 - 11 percentage points) more likely to take up the reserved space during rides with zero opportunity cost ($p < 0.1$; Columns 1-6, Panels A and B, Table A9). However, this additional effect goes to zero when riding the reserved car requires forgoing a payment ($\hat{\beta}_{P_1} - \hat{\beta}_{P_3}$, Panel B, Table A9).

Riders who perceive a higher chance of physical and verbal harassment are more likely to use the reserved space. These results motivate further analysis of harassment as a key mechanism underlying demand for the reserved space.

6 Harassment as a Mechanism for the Value Women Place on the Reserved Space

Over 80 percent of the riders in our experiment report safety and avoiding harassment as main reasons for using the women-reserved space (Figure A8); and we showed in Section 5.4 that perceiving a higher risk of sexual harassment is associated with a higher demand for the reserved space. We now leverage experimental variation in ride location to formally

document harassment as a demand mechanism for the reserved space. We start by estimating the impact of riding in the reserved space on the incidence of harassment relative to riding in the public space. We then combine data from our revealed preference experiment with experimental variation in riding location to relate incidence of harassment to riders' demand for the reserved space. Finally, we explore the role of perceived norms around a woman's choice of space in driving demand for the reserved space.

6.1 Experimental Assignment to the Reserved or the Public Space

We run an experiment in which we assign riders a paid offer to ride in either the reserved space or the public space at random, and ask them to report on their ride experience through the app.

In contrast with the setup in the previous phase, riders are now offered a ride task for a specific space for a fixed payment of $4.70 per ride through the same app.[30] Upon logging into the app, a participant could see only whether she had an offer on that day and, if so, in which space she was assigned to ride (Panel (c), Figure 1). Each participant was offered several iterations of each car type in a random sequence across days and could not predict their sequence of rides. The space assignment on a given day was independent of previous assigned spaces and a rider's decision to take up those tasks. At the end of each ride, participants were asked to report experiences of harassment on their journey, including whether any stranger had "made comments that made you uncomfortable", "touched you intentionally in a way that made you feel uncomfortable", or "stared at you". Whenever a rider reported any harassment, the app directed her to resources available in the Rio area. Participants were also asked if they felt concerned about physical harassment and to report their emotional state on a scale of 1 to 10, overall and on specific items: happy, sad, tense, relaxed, frustrated, and satisfied.

[30] Pay-out at this stage was fixed at the highest pay-out from the previous phase, to avoid discouragement (Table A2).

6.2 Reduced-Form Results

We now estimate the impact of being randomly assigned to ride in the reserved space on riders' self-reported experiences of harassment and emotional state, relative to being assigned to ride in the public space. We estimate the following equation:

$$y_{i,t} = \alpha + \beta \text{Assigned to Reserved Space}_{i,t} + \gamma_i + \epsilon_{i,t} \tag{4}$$

Where Assigned to Reserved Space indicates whether rider i was assigned to ride in the reserved space during ride t; all specifications include individual rider fixed effects α_i, and standard errors are clustered at the rider level. We weigh observations by $\frac{1}{N_i}$, the inverse of the number of rides taken by the individual rider throughout the assigned-ride exercise. Coefficient estimates are reported in Table 3.

Overall, results indicate that the incidence of harassment is high: riders assigned to the public space report experiencing some form of harassment (physical, verbal, or staring) in 18 percent of rides, or once a week on average, and physical harassment in 2.6 percent of rides. When randomly assigned to ride in the reserved space, riders are 2.5 percentage points less likely to report experiencing any harassment, or a 14.2 percent reduction relative to riding in the public space (Columns 1-2, Panel A, Table 3). Columns 3-8 break this down by type of harassment. We observe that the effect is driven by a sharp reduction in the probability of experiencing physical harassment (1.3 percentage points, or a 50 percent reduction on the mean in the public space). The effects on verbal harassment and staring are smaller and imprecisely estimated.

Table A10, Panel A, shows the effects on measures of women's subjective well-being. Being randomly assigned to the reserved space translates into imprecisely estimated improvements on some measures: riders are more likely to report feeling happy and less likely to report feeling sad and frustrated. However, there is no statistically detectable effect on an index constructed on all measures.

6.3 Avoiding Harassment by Avoiding Men

We showed in Section 5 that the *de facto* effectiveness of the reservation rule is an important determinant of riders' demand for the reserved space. If this operates through the avoiding harassment channel, we should also observe that the presence of men predicts harassment. We interact Assigned to Reserved Space$_{i,t}$ with a set of dummies indicating whether the average presence of men in the reserved space at ($time \times location$) of ride t was above or below median, as follows:[31]

$$\begin{aligned} y_{i,t} = {} & \beta_{H_1}\text{Assigned to Reserved Space}_{i,t} \times \text{Few Men in Reserved Space}_t \\ & + \beta_{H_2}\text{Assigned to Public Space}_{i,t} \times \text{Few Men in Reserved Space}_t \\ & + \beta_{H_3}\text{Assigned to Reserved Space}_{i,t} \times \text{Many Men in Reserved Space}_t \\ & + \beta_{H_4}\text{Assigned to Public Space}_{i,t} \times \text{Many Men in Reserved Space}_t + \gamma_i + \epsilon_{i,t} \end{aligned} \tag{5}$$

We find that the reduction in harassment as a result of riding in the reserved space is sharpest at times when the reservation rule is well adhered to and goes to zero when adherence is low. Results are reported in Panel B of Table 3. Equation (5) does not include a constant, and the categories are mutually exclusive and exhaustive, so the difference in coefficients, $(\hat{\beta}_{H_1} - \hat{\beta}_{H_2})$, shown in the table footer, is the effect of being assigned to the reserved space when the reservation rule is being followed. We compare this to the effect when the rule is not followed, $(\hat{\beta}_{H_3} - \hat{\beta}_{H_4})$. The protective impact of the reserved space is largest when the reservation rule is more closely followed: being assigned to the reserved space then reduces the incidence of physical harassment by 1.7 percentage points ($p = 0.004$) ($\hat{\beta}_{H_1} - \hat{\beta}_{H_2}$, Columns 3-4). This is a reduction of 65 percent over the mean harassment in the public space. This effect is one-third the size and imprecisely estimated when the reservation

[31] As discussed in Section 3.1, this measure is based on the average of observations by third party platform observers traveling in the same location, day and time slot. Thus it represents the conditions that a participant can expect on her ride when she makes her decision to board the reserved or public space. It is not based on a rider's observation or perception from within the train.

rule is not well followed.

6.4 Who is Most Affected by Harassment?

We now test whether the highly heterogeneous patterns of use of the reserved space (described in Section 5.4) can be at least partially explained by differences in the distribution of protective benefits of the policy across users. We again split our sample by the high- vs. low-level users to focus attention on the women who use the reserved space the most.

We find that higher demand for the reserved space maps directly to higher vulnerability to harassment in the public space. The third series in Figure 3 shows that high-level users of the reserved space report physical harassment in about 5 percent of their rides in the public space - two to three times as often as the middle and low-level users, respectively. These high-level users of the reserved space experience over half of the incidents of harassment reported during our study period.

We then investigate whether the protective benefits of the reserved space are concentrated among high-level users. Figure A9 examines heterogeneous effects of randomized assignment to the reserved space across high- and low-level users of the reserved space. While the estimates are imprecise, the pattern of results show a gradient consistent with the idea that the women who experience the largest decrease in harassment from moving to the reserved space are also those who choose it most frequently: the point estimate of the impact of riding in the reserved space is 50 percent larger for high-level users than for low-level users.

Consistent with these results, we also find that high-level users also report the highest positive impacts of being assigned to ride in the reserved space on their emotional state. Table A10, Panel B breaks down the emotional state estimates for the high-level and low-level users; Column 1 shows the summary index, while subsequent columns show the component variables. There is a precisely estimated gradient of effects, with the mid-level users and the high-level users seeing progressively more benefits from being assigned to the reserved space.

This substantial heterogeneity in the sample demonstrates that there is a minority of

women who are particularly likely to experience harassment, and these women drive demand for the reserved space as well as the benefits from using it to avoid men. It is possible that they are more likely to recognize or record an incident of harassment; however, note that the questions in the rider experiment use neutral terminology to elicit incidents of harassment (Section 6.1). Regardless, these users are effectively more *vulnerable* to harassment and more affected by its prevalance in making decisions about their commute.

7 Complying with Norms

We now bring the results from the revealed preference exercise and the randomized experiment together to examine whether riders place a value on riding in the reserved space above and beyond the protection the space offers against harassment. This is relevant especially as *de facto* compliance to the reservation rule is largely imperfect.

Figure 4 divides the sample by the extent to which the reservation rule is followed: the difference between the presence of men on the reserved versus the public space. The figure shows how both takeup of the reserved space and the impact of the random assignment to the reserved space on physical harassment vary across the distribution of compliance to the reservation rule. As the presence of men equalizes across spaces, the protective value of the reserved space against harassment vanishes. In the bottom two quintiles, i.e. 40 percent of rides, riding the reserved space does not reduce harassment because the reservation rule is not well followed. Surprisingly, however, riders' willingness to pay to ride in the reserved space does not go to zero. This suggests that, while they value the protective nature of the reserved space, women riders also place a large positive fixed-amenity value on riding in the reserved space.

While participants' willingness to pay correspondingly decreases with the presence of men, take-up of the reserved space under positive opportunity cost remains positive. The results in Figure 4 show that participants' willingness to pay for the reserved space in the

absence of a protective benefit against harassment is 70 percent of willingness to pay when there is a protective benefit. What explains the fixed-amenity value of the reserved space even when it is not effectively reserved?

First, we show that the "high-level" users, who we showed in Sections 5.4 and 6.4) report the highest level of harassment and have the highest willingness to pay to ride in the reserved space, also ascribe the largest fixed-amenity value to the reserved space. Figure A10 examines how demand for the reserved space by these groups varies by the *de facto* effectiveness of the reservation rule. High-level users of the space have not only higher demand overall, but also demonstrate a higher demand for the reserved space even when there is effectively no difference between the reserved and public spaces in terms of presence of men and, therefore, protection from harassment.

Second, we show that attitudes and perceived social norms around women's choice of space are correlated with women's demand for the reserved space. We showed in Section 4.3 that men and women commuters tend to associate women riding in the public space as more open to advances. Table 4 uses these same platform survey and IAT data to relate women's demand for the reserved space with their perceived risk of harassment and their first- and second-order beliefs about women's choice of space. Specifically, we regress a dummy for usually riding in the reserved space (which corresponds to being a high-level user in our experimental sample) on the following measures of the respondent's first- and second-order beliefs: the respondent's IAT D-score associating the choice of the public space with sexual openness (column 1); the explicit measure of the respondent's *first-order* belief that women who choose the public space are provoking harassment (column 2); and her *second order* belief about how other women (column 3) and men (column 4) commuters would answer this question.

We observe a small, imprecisely estimated positive relationship between women's own (first-order) beliefs about women's behavior and their choice of the reserved space (Table 4, columns 1-2). However, women's *second-order beliefs* strongly predict women's takeup of the

reserved space. Women who perceive this attitude to be the prevailing norm among men are 79 percent (23 percentage points) more likely to ride in the reserved space than those who do not (column 4). This correlation could arise through a channel of increased perceived risk of harassment: women who perceive this attitude to be the norm may expect men to act accordingly and harass them. However, two points suggest that this is not the only mechanism for this relationship. First, women's second order beliefs about other *women's* beliefs are also strongly correlated with their choice of the reserved space, with a similar magnitude (column 3). Second, the estimates are also similar with and without conditioning on the respondent's perceived probability of harassment in the public space (Panel A vs. B). This result echoes the result of a fixed-amenity value arising from our rider experiments (Section 7), and is consistent with the idea of a social norm that it is more appropriate for women to choose the reserved space drives demand for the reserved space.

8 Alternative Mechanisms and Robustness

We now investigate journey planning, avoiding other crimes, sorting of perpetrators, and congestion as alternative mechanisms that may underlie both riders' demand for the reserved space and affect our interpretations of treatment effects when riders are randomly assigned to ride in a given space. We find that these channels are unlikely to explain our results or affect our conclusions.

8.1 Journey Planning as a Margin of Adjustment

In this sub-section, we leverage our rich ride-level data to explore the possibility that that riders respond to the experimental variation in opportunity cost or choice of space generated through the app by making changes in their itinerary.

We start by testing whether riders respond to our offer of a higher payment to ride in the public space by adjusting their travel plans at other margins. Specifically, we investigate

whether route choice, travel time, or space switching is affected by our assignment to a positive opportunity cost to ride in the reserved space (Panel A, Table A11). We find small imprecise effects of assigning a positive opportunity cost on the reserved space across all these margins of adjustment.

We perform the same exercise for the phase of our experiment in which we assign riders to ride in either the reserved or the public space (Panel B, Table A11). Columns 3 and 4 show that riders assigned to the public space are 1.5 percentage points more likely to report that they switched between spaces at some point during the ride, and four percentage points more likely to report that they moved within the space. These adjustments are small, and if anything suggest that our intent-to-treat results from the randomized experiment would be slightly biased towards zero. There is no meaningful adjustment on other margins.

We conclude that rider responses by adjusting their journey planning do not have a meaningful impact on our results.

8.2 Avoiding Other Crimes

Women might elect to ride in the reserved space to avoid exposure to other crimes. Qualitative work suggests this is not the case: women in the focus group discussion said that, while they fear for their safety on the train in general, they do not feel that riding in the women-reserved changes the odds of this type of violence, relative to the public space. In line with this notion, while we find that perceiving a high risk of physical or verbal harassment affects a rider's demand for the reserved space, perceiving a high risk of robbery does not affect take up of the reserved space (Columns 7-9, Panels A and B, Table A9).

8.3 Sorting of Perpetrators Across Spaces

While our results so far establish a lower presence of men in the reserved space, this does not rule out potential sorting of men across spaces, which in turn could in part explain the protective benefit of the reserved space. In this were the case, we should observe differences

in harassment across spaces even at similar presence of men. This is not what we observe empirically (Figure 4). Another way sorting of men across spaces could manifest in our data would be a decrease in harassment in the public space as perpetrators are able to enter the reserved space, while harassment in the reserved space would increase as share of men in the public space goes down. Instead, we find no impact of presence of men in the reserved space on harassment in the public space, and vice versa (Figure A11). However, we cannot test whether perpetrators sort between cars when the rule *is* well followed, because we do not observe situations with few men in the public space (Figure A3).

8.4 Congestion

Congestion could play a role in two ways in our analysis. First, if congestion differed between the reserved and public spaces, this would create another mechanism affecting willingness to pay. However, both administrative and rider audit data show that congestion levels are almost identical across the reserved and public spaces (Figure A2). Our main estimates all control for above-median congestion.

Second, congestion could also create a type of measurement error in our analysis. At times of extreme congestion, participants may be physically unable to select the car they prefer, such that the car they select (which we observe) does not represent the car they prefer (unobserved). This would bias our estimates of mean takeup toward 13 - 17 percent for these observations (because one of each train's six to eight cars is designated as a reserved space). This is well below the takeup rates for the "high level users" and above the levels for the other two thirds of the sample (Figure 3). This suggests that if anything this kind of measurement error could (a) bias the estimates for the high-level users downwards, and (b) reduce the estimated differences between the three groups. We explore this in Figure A12, which describes the relationship between congestion and (1) demand for the reserved space, and (2) the share of men in the women-reserved space. We notice that, at low levels of congestion, the share of men in the reserved space is flat, at about 20 percent. As congestion

passes the 0.4 load factor mark, which applies to 41 percent of rides, the proportion of men in the reserved space starts to increase, and demand for the reserved space drops accordingly. As the load factor passes 0.8, which is the case in 1.3 percent of rides, the mean takeup of the reserved space drops further to approximately 18 percent; even at this extreme of the distribution, observed takeup is still greater than the 13-17 percent expected if women participants board completely at random, suggesting that this kind of measurement error is unlikely to have a significant effect on our analysis. In addition, above-median crowding does not predict takeup of the reserved space in Table 2, again suggesting that this kind of measurement error is only an issue in a minority of observations with extreme congestion.

9 Conclusion

In this paper, we study the impacts of a women-reserved space policy on the incidence of harassment in Rio de Janeiro's public transit and the drivers of demand for a women-reserved space. We innovate by providing women a secure platform to report experiences of harassment, experimentally varying tasks to measure differences in the incidence of harassment across public and reserved spaces, varying payouts to measure women's willingness to pay for the reserved space, and leveraging high-frequency data of riding condition to explore various demand mechanisms such as congestion and presence of men. We formally document two drivers of demand for the reserved space: avoiding men (and, thus harassment) and complying with norms.

These data highlight that harassment is shockingly common on the public transit system and that the reserved space offers women commuters a relative respite. We find that a woman commuter traveling in the public space experiences harassment on average once a week. Riding in the reserved space reduces the incidence of physical harassment by 50 percent. We observe, however, that this protective effect goes to zero as the presence of men increases, which applies to about 40 percent of the rides we record. We show stark

heterogeneity in who uses and values the space most: high-level users are those who are not only most vulnerable to sexual harassment but also benefit most from the protection the reserved space offers.

We go beyond these partial equilibrium results and interview other men and women commuters on the platform to record their stated and implicit attitudes toward women commuters riding in the public space. Our evidence suggests that providing a reserved space reinforces the notion that it is not appropriate for women to choose the public space. While riding in the public space is the operating norm for women commuters, 49 percent of men and 41 percent of women commuters we interviewed on the platform stated that women in the public space are more likely to accept advances. We show that women who perceive this attitude to be the norm are also more likely to elect to ride in the reserved space.

Back of envelope calculations (detailed in Appendix F) show that, while harassment in the public space imposes an economically meaningful tax on women, the welfare implications of offering a reserved space are both heterogeneous and ambiguous. The most vulnerable, high-level users experience an implied cost of 12 cents per ride, and \$2.81 per incident, in contrast with \$0.16 per incident for the least vulnerable. In addition, only 40 percent of the value of the reserved car can be linked directly to avoiding harassment, the other 60 percent appears to come from a fixed-amenity value, which we interpret to be partially driven by a fear of breaking the perceived norm. Taken together, these findings indicate that the cost of the reserved space policy to women commuters may be as large as the protective value it offers.

Policies that designate women-reserved spaces draw controversy. While this calls for more rigorous evidence on the impact of these policies, this paper contributes to filling this gap. We formally document that a reservation policy on the transit system of a large metropolis generates highly heterogeneous demand, benefits, and attitudes, our results provide a framework to unpack the forces underlying these starkly opposing views. The tension between what the women-reserved space *de facto* offers and the expectation it places on women's

behavior highlights that designating women-only areas can reinforce norms against women sharing the public space; this may in turn constrain a woman's agency over her movement.

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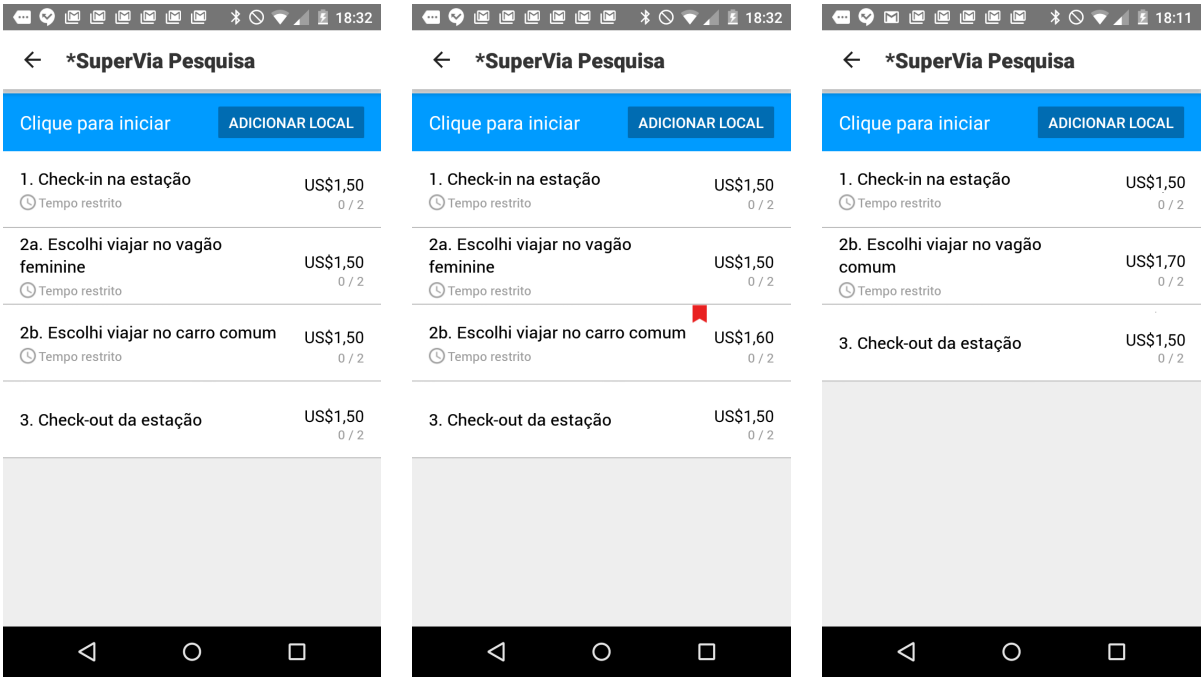
Figures

Figure 1: Crowdsourcing app interface across different phases of the study

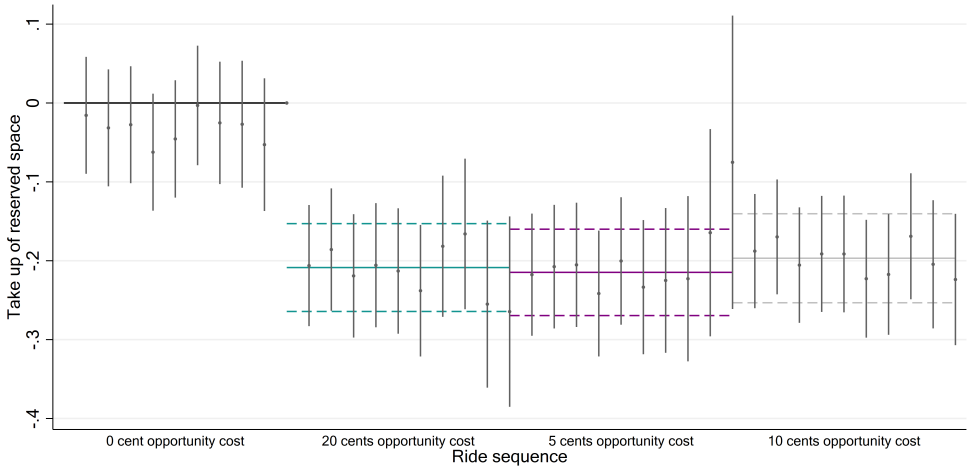


(a) Revealed preference: zero opportunity cost

(b) Revealed preference: positive opportunity cost

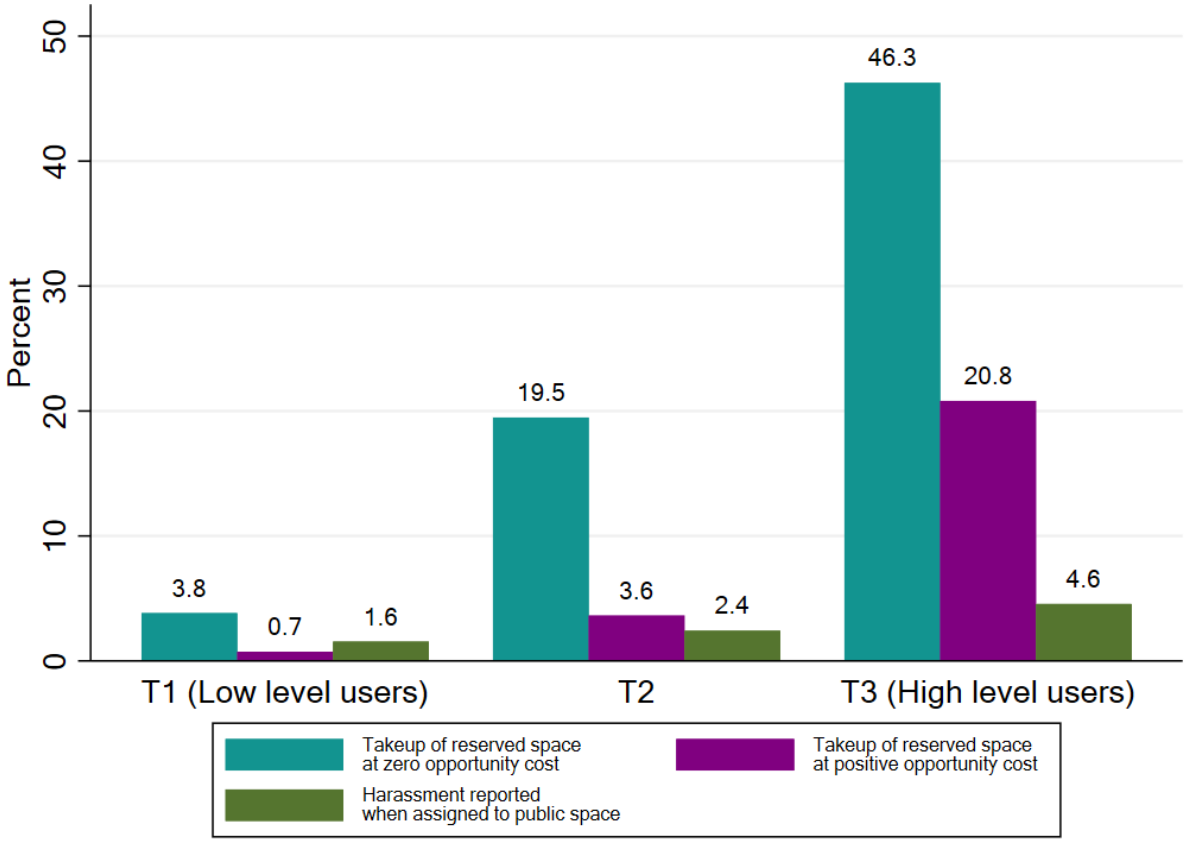
(c) Random assignment to a space

Figure 2: Take up of reserved space during the revealed preference experiment



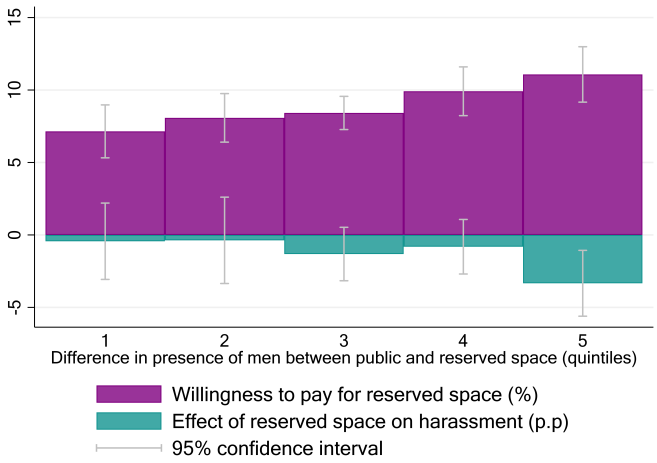
Note: Vertical lines show event study estimates and 95% confidence intervals from the event study specification (Equation 2). Omitted ride (take up = 0) is the last ride with no opportunity cost. Horizontal solid lines show DiD estimates (Equation 1); dashed colored lines show 95% confidence intervals from the DiD estimates. Sample includes all riders who started willingness to pay rides. We limit the sample to the common sequence of offers all riders were offered to visualize results by opportunity cost level, and include only the last ten rides each user took for each opportunity cost level.

Figure 3: Heterogeneity in use of the reserved space and incidence of harassment across rider types



Note: Graph divides participants in the rider experiment into terciles of use of the reserved space throughout the revealed preference experiment. Series 1 is the takeup of the reserved space in the revealed preference experiment zero opportunity cost; Series 2 is the takeup of rides with a positive opportunity cost; Series 3 is the incidence of reported physical harassment when randomly assigned to the public space.

Figure 4: Use of reserved space and effect of reserved space on harassment by presence of men



Note: The X axis shows quintiles of differential presence of men between the public and reserved space. Series 1 (purple - willingness to pay): Sample includes rides in the revealed preference experiment in which respondents faced a positive opportunity cost for the reserved space. Bars show predicted values from a regression of takeup of the reserved space on these quintiles; i.e. for quintile, the bar shows she percentage of rides in which the respondent gave up the opportunity cost to use the reserved space. Series 2 (teal - effect of reserved space on harassment): Sample includes rides in the phase when riders are randomly assigned to a space. Bars show point estimates of a regression of physical harassment on assignment to the reserved space interacted with these quintile indicators, i.e. for each quintile the bar shows the impact of assignment to reserved space on harassment. Series 1 and 2: All estimates include respondent fixed effects. Standard errors are clustered at rider level. Observations are weighted observations by the inverse of the number of rides taken by the individual rider.

Tables

Table 1: Descriptive statistics of our study samples: riders through the app and platform survey respondents

	Riders Mean/SE (1)	Platform survey: women Mean/SE (2)	Platform survey: men Mean/SE (3)	Difference (2) - (1) (4)	Difference (2) - (3) (5)
Panel A: Demographic variables					
Employed	0.678	0.913	0.927	0.235***	-0.0150
	(0.025)	(0.018)	(0.017)		
Age	32.51	37.22	36.41	4.712***	0.808
	(0.617)	(0.665)	(0.763)		
Years of schooling	12.95	11.31	11.01	-1.643***	0.304
	(0.186)	(0.277)	(0.241)		
Number of rides in a typical week	6.055	8.467	8.934	2.412***	-0.467*
	(0.260)	(0.169)	(0.183)		
Crime rate at rider home station	1367	1233	1178	-134.073**	54.85
	(38.908)	(48.298)	(42.969)		
Violent crimes at rider home station	45.39	47.77	46.91	2.377**	0.853
	(0.660)	(0.785)	(0.717)		
Crimes against property at rider home station	263.8	228.9	214.8	-34.901**	14.08
	(9.427)	(11.796)	(10.558)		
Panel B: Self-reported risk of harassment (number of occurrences in a year)					
Physical, reserved space	12.35	25.86	28.50	13.502***	-2.639
	(2.578)	(4.035)	(4.419)		
Physical, public space	21.14	62.75	64.13	41.615***	-1.382
	(3.555)	(5.026)	(5.317)		
Verbal, reserved space	22.95	39.80	39.64	16.849***	0.165
	(3.644)	(4.622)	(4.906)		
Verbal, public space	40.08	84.47	82.97	44.393***	1.5
	(4.682)	(5.335)	(5.606)		
Panel C: Self-reported share of reserved space rides under hypothetical scenarios					
Status quo	0.472	0.551	-	0.079***	-
	(0.017)	(0.022)	-		
Current scenario, 30 cents opportunity cost	0.374	0.466	-	0.092**	-
	(0.023)	(0.040)	-		
Current scenario, 65 cents opportunity cost	0.278	0.374	-	0.096**	-
	(0.021)	(0.040)	-		
No men on reserved space, 30 cents opportunity cost	0.514	0.577	-	0.0630	-
	(0.025)	(0.040)	-		
No men on reserved space, 65 cents opportunity cost	0.385	0.511	-	0.125***	-
	(0.023)	(0.042)	-		

Note: Unit of observation is one rider in column (1) and one platform survey respondent in columns (2) and (3). Sampling weights are applied to platform survey observations. Standard errors in parentheses, clustered at rider level. For risk of harassment questions, women were asked to imagine a rider similar to themselves who takes the same commuting route, while men were asked to imagine an average woman who takes the same commuting route. Crime data from Instituto de Seguranca Publica do Rio de Janeiro is reported as number of crimes per 100k residents in the area.

Table 2: Take up of the reserved space under positive opportunity cost, overall and by presence of men

	Dependent variable: Chose reserved space	
	(1)	(2)
Panel A: Overall		
Positive opportunity cost	-0.164	-0.163
	(0.011)	(0.010)
High crowding		-0.008
		(0.012)
Few men in reserved space		0.041
		(0.009)
Constant	0.249	0.228
	(0.005)	(0.007)
Mean dependent variable		
Zero opportunity cost	0.245	
	(0.014)	
Panel B: Heterogeneous effects by male presence in reserved space		
$\hat{\beta}_{M_1}$: Positive opportunity cost × Few men in reserved space	0.096	0.096
	(0.008)	(0.008)
$\hat{\beta}_{M_2}$: Zero opportunity cost × Few men in reserved space	0.280	0.280
	(0.009)	(0.009)
$\hat{\beta}_{M_3}$: Positive opportunity cost × Many men in reserved space	0.074	0.075
	(0.007)	(0.007)
$\hat{\beta}_{M_4}$: Zero opportunity cost × Many men in reserved space	0.216	0.216
	(0.008)	(0.008)
Mean dependent variable		
Zero opportunity cost × Few men in reserved space	0.293	
	(0.019)	
Zero opportunity cost × Many men in reserved space	0.194	
	(0.014)	
Observations	17047	17047
Riders	363	363
Control for high crowding	No	Yes
Rider fixed effect	Yes	Yes
Post-estimate tests for heterogeneous effects		
By opportunity cost: zero opportunity cost - positive opportunity cost		
Few men in reserved space: $\hat{\beta}_{M_2} - \hat{\beta}_{M_1}$	0.184	0.184
P-value	0.000	0.000
Many men in reserved space: $\hat{\beta}_{M_4} - \hat{\beta}_{M_3}$	0.141	0.142
P-value	0.000	0.000
By male presence in reserved space: few men - many men in reserved space		
Zero opportunity cost: $\hat{\beta}_{M_2} - \hat{\beta}_{M_4}$	0.064	0.064
P-value	0.000	0.000
Positive opportunity cost: $\hat{\beta}_{M_1} - \hat{\beta}_{M_3}$	0.022	0.021
P-value	0.042	0.050

Note: A ride is the unit of observation. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

Table 3: Impact of random assignment to the reserved space on reported harassment, overall and by presence of men

	Dependent variable:							
	Any harassment		Physical harassment		Verbal harassment		Staring	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Overall impact of randomized assignment								
Assigned to reserved space	-0.025	-0.025	-0.013	-0.013	-0.009	-0.009	-0.007	-0.007
	(0.013)	(0.013)	(0.005)	(0.005)	(0.008)	(0.008)	(0.012)	(0.012)
High crowding		0.005		-0.013		0.002		-0.002
		(0.029)		(0.014)		(0.011)		(0.028)
Few men in reserved space		-0.004		0.002		0.005		-0.011
		(0.018)		(0.008)		(0.008)		(0.016)
Constant	0.168	0.169	0.031	0.031	0.058	0.055	0.124	0.129
	(0.006)	(0.012)	(0.002)	(0.005)	(0.004)	(0.006)	(0.006)	(0.010)
Mean dependent variable								
Assigned to public space	0.176		0.026		0.066		0.128	
	(0.013)		(0.004)		(0.009)		(0.013)	
Panel B: Impact of randomized assignment by presence of men in reserved space								
$\hat{\beta}_{H_1}$: Assigned to reserved space × Few men in reserved space	0.139	0.139	0.018	0.017	0.052	0.052	0.109	0.108
	(0.012)	(0.012)	(0.004)	(0.005)	(0.006)	(0.006)	(0.011)	(0.011)
$\hat{\beta}_{H_2}$: Assigned to public space × Few men in reserved space	0.167	0.167	0.035	0.034	0.061	0.061	0.121	0.121
	(0.012)	(0.012)	(0.005)	(0.005)	(0.006)	(0.006)	(0.011)	(0.011)
$\hat{\beta}_{H_3}$: Assigned to reserved space × Many men in reserved space	0.146	0.146	0.019	0.020	0.047	0.047	0.125	0.125
	(0.013)	(0.013)	(0.006)	(0.006)	(0.007)	(0.007)	(0.011)	(0.012)
$\hat{\beta}_{H_4}$: Assigned to public space × Many men in reserved space	0.168	0.168	0.027	0.028	0.056	0.056	0.126	0.126
	(0.014)	(0.014)	(0.005)	(0.005)	(0.008)	(0.008)	(0.011)	(0.011)
Mean dependent variable								
Assigned to public space × Few men in reserved space	0.141		0.025		0.053		0.095	
	(0.023)		(0.006)		(0.014)		(0.02)	
Assigned to public space × Many men in reserved space	0.209		0.027		0.078		0.161	
	(0.024)		(0.007)		(0.019)		(0.021)	
Observations	3695	3695	3695	3695	3695	3695	3695	3695
Riders	259	259	259	259	259	259	259	259
Control for high crowding	No	Yes	No	Yes	No	Yes	No	Yes
Rider fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-estimate tests for heterogeneous effects								
Impact on harassment when few men in reserved space: reserved space - public space								
$\hat{\beta}_{H_1}$ - $\hat{\beta}_{H_2}$	-0.028	-0.028	-0.017	-0.017	-0.009	-0.009	-0.012	-0.012
P-value	0.087	0.087	0.004	0.004	0.366	0.367	0.454	0.453
Impact on harassment when many men in reserved space: reserved space - public space								
$\hat{\beta}_{H_3}$ - $\hat{\beta}_{H_4}$	-0.022	-0.022	-0.008	-0.008	-0.008	-0.008	-0.002	-0.002
P-value	0.259	0.260	0.264	0.259	0.501	0.502	0.924	0.923

Note: Unit of observation is one ride. Sample includes randomized assignment of space rides for riders who started such rides. Rides with no corresponding platform audits were dropped. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

Table 4: Perception of norms is associated with women's use of the reserved space

Panel A: Unconditional				
	Usually chooses reserved space			
	(1)	(2)	(3)	(4)
D-Score on Provokes Advances IAT	0.179			
	(0.127)			
First order belief: women in public space more likely to accept advances		0.081		
		(0.088)		
Second order belief - women: women in public space more likely to accept advance			0.170	
			(0.078)	
Second order belief - men: women in public space more likely to accept advances				0.227
				(0.112)
Observations	143	155	155	155
Panel B: Conditional on perceived probability of harassment				
	Usually chooses reserved space			
	(1)	(2)	(3)	(4)
Expect any physical harassment in public space	0.447	0.516	0.471	0.516
	(0.089)	(0.086)	(0.087)	(0.090)
Expect frequent physical harassment in public space	0.021	-0.008	-0.037	-0.048
	(0.109)	(0.107)	(0.110)	(0.107)
D-Score on Provokes Advances IAT	0.164			
	(0.125)			
First order belief: women in public space more likely to accept advances		0.080		
		(0.087)		
Second order belief - women: women in public space more likely to accept advance			0.151	
			(0.083)	
Second order belief - men: women in public space more likely to accept advances				0.229
				(0.107)
Observations	143	155	155	155
Sample mean Y | X = 0		0.460	0.392	0.286

Note: Unit of observation is an individual. Subsample of female platform survey respondents who were randomly allocated both harassment probability and attitude questions. All estimates include controls for employment, age, education, and platform fixed effects. Sampling weights are applied to platform survey observations. Robust standard errors in parentheses.

A For Online Publication: Supplementary Figures and Tables

Figure A1: SuperVia lines and riders home location

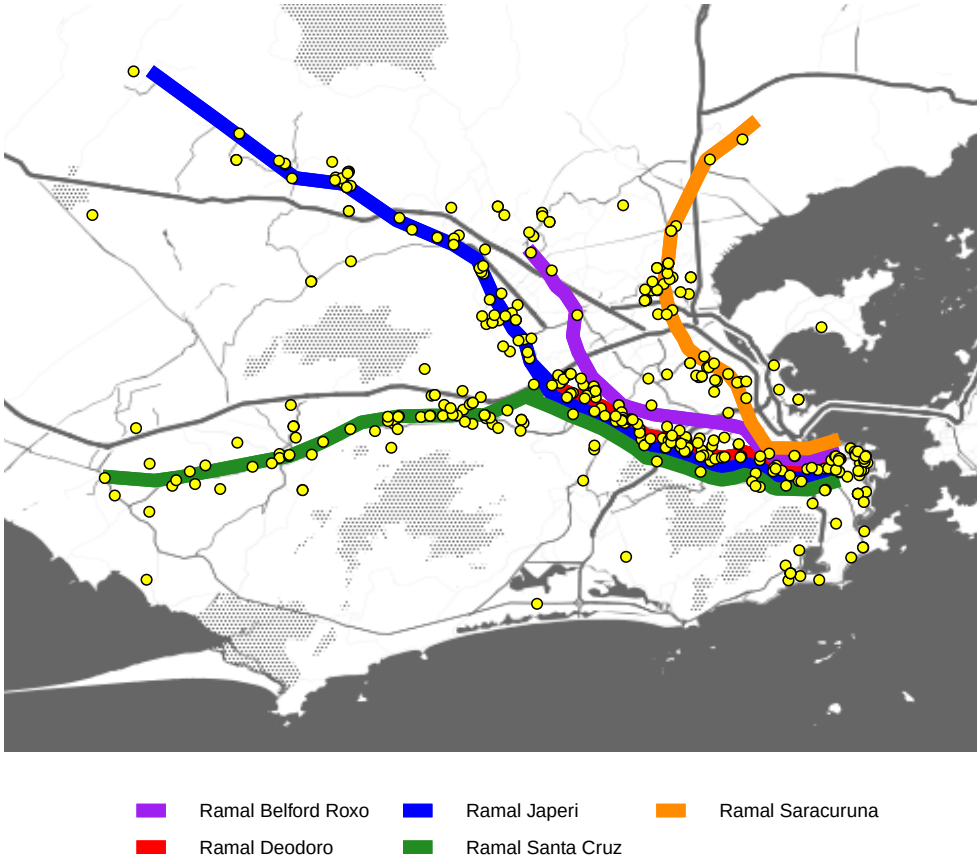
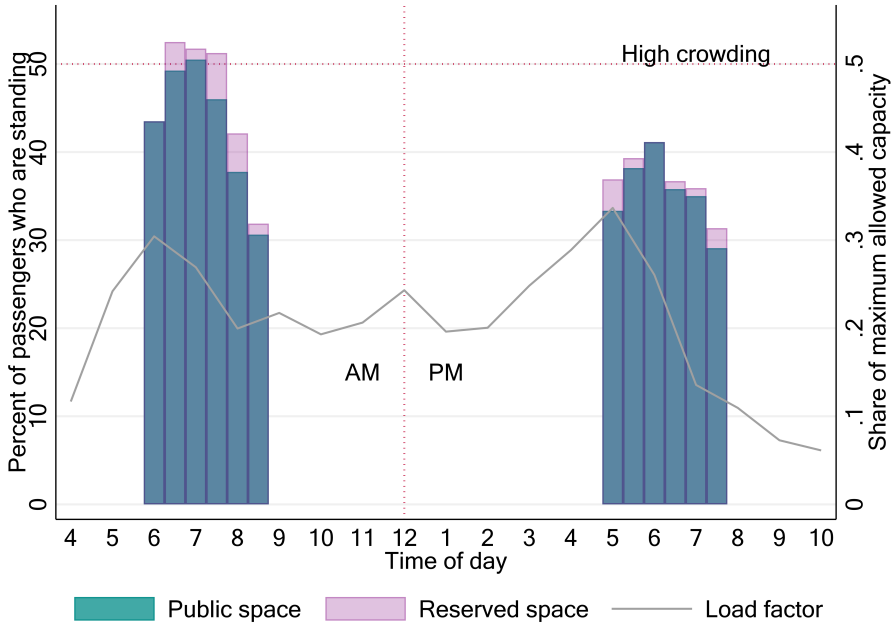
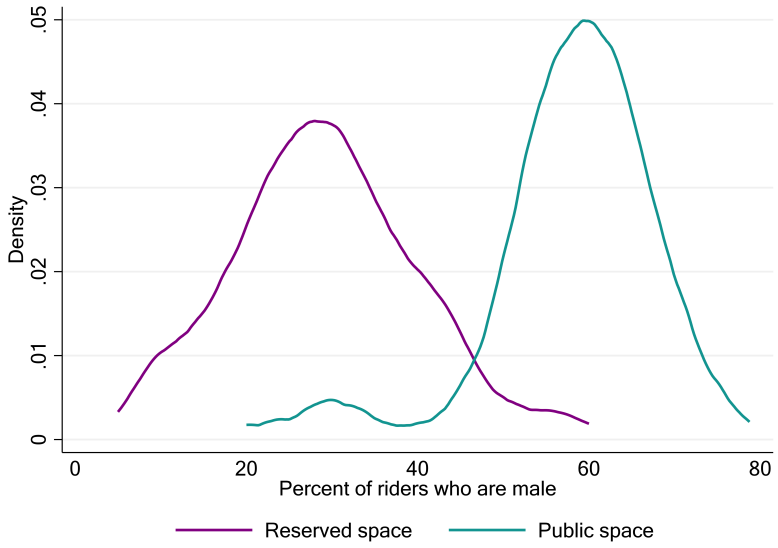


Figure A2: Congestion in the system by time window



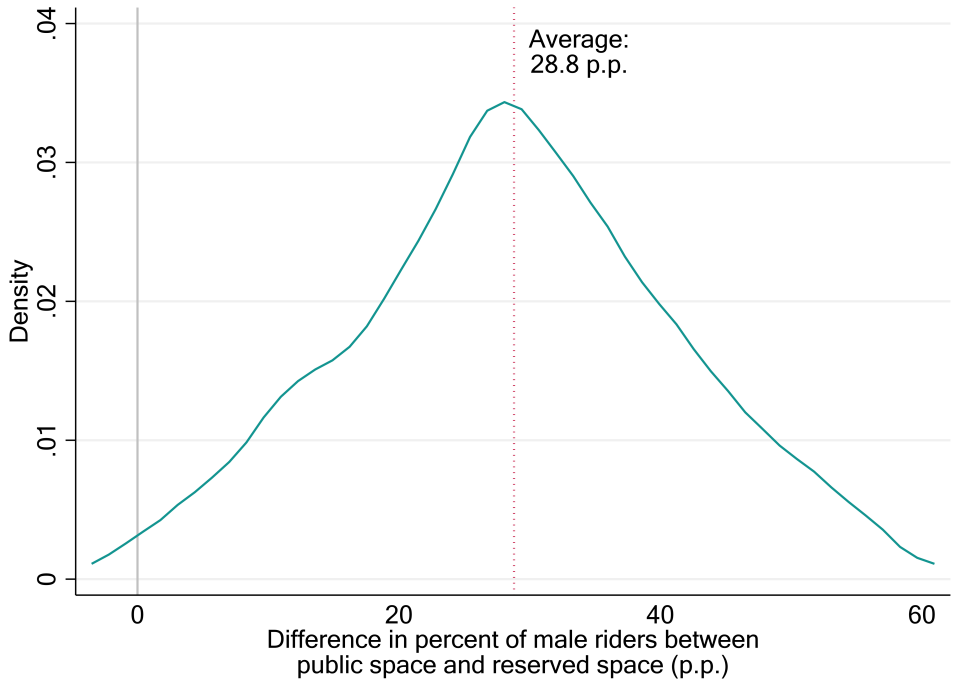
Note: Platform reports observations from rider study correspond to rush hour windows, when riders could submit ride observations for the study. Administrative data about load factor was obtained from Supervia.

Figure A3: Presence of men by space



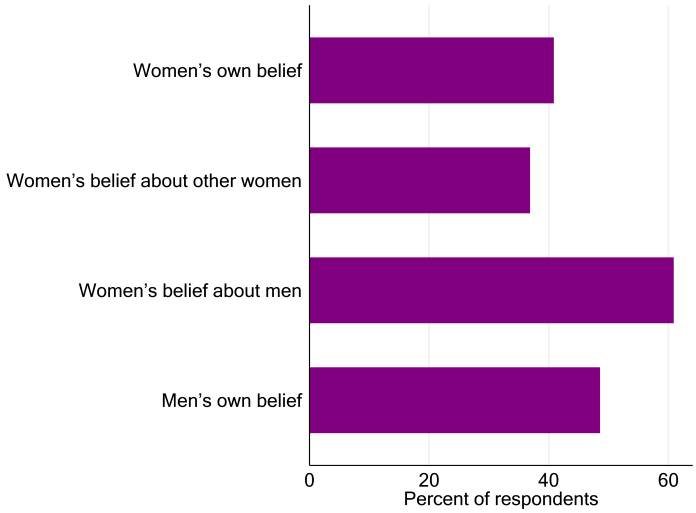
Source: Platform observations.

Figure A4: Difference in presence of men across public and reserved spaces at a given time and place



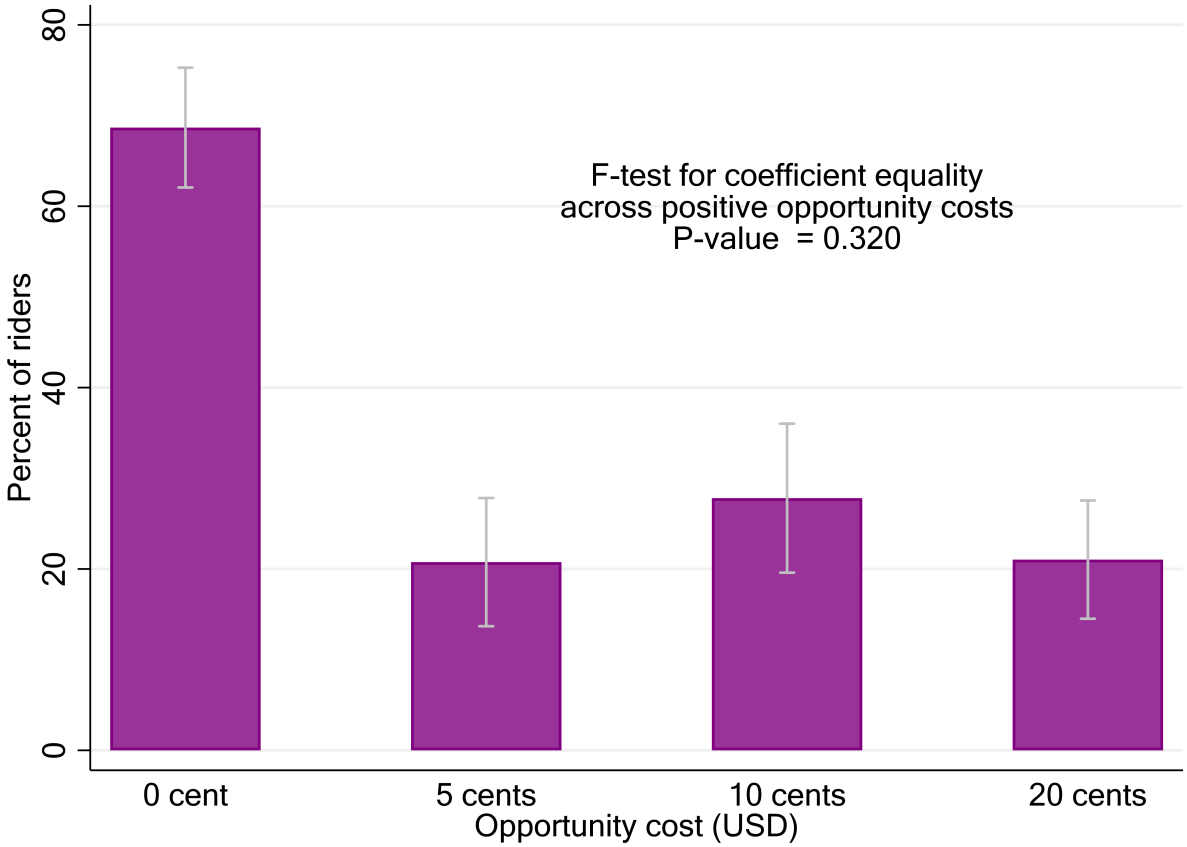
Source: Platform observations.

Figure A5: First and second order beliefs: percent of respondents who believe women who ride the public space are more open to advances than those who ride the women-reserved space



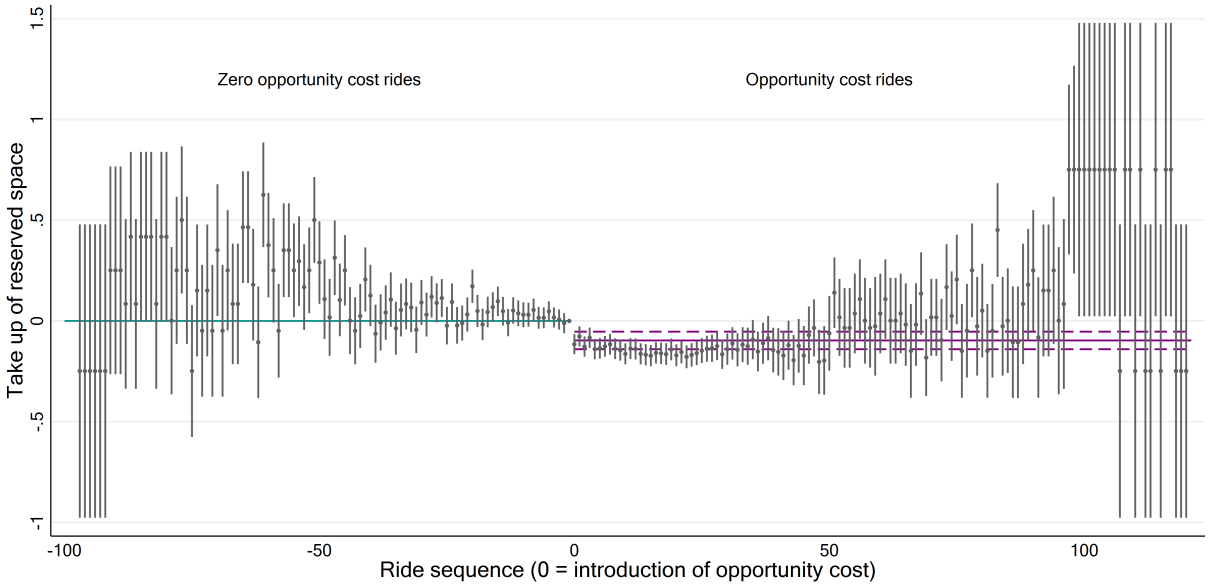
Note: Variables from platform survey. Sampling weights applied.

Figure A6: Percentage of riders who ever use the reserved space at each opportunity cost level

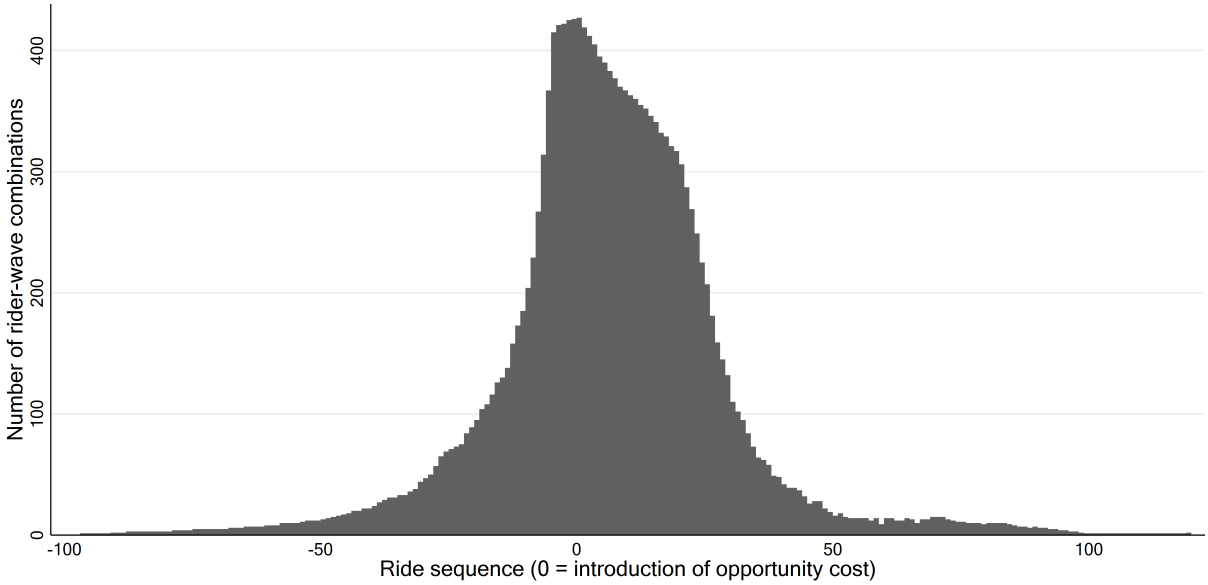


Note: Displayed percentages are predictions from a regression of take-up of the reserved space on dummies for the different opportunity cost levels. Figure only includes rides from the revealed preference phase of the 261 riders who completed revealed preference rides. Standard errors in parentheses, clustered at rider level. Observations weighted by the inverse of the number of rides taken by the individual rider. Observations are at rider / opportunity cost level.

Figure A7: Rides sequence and take-up of reserved space



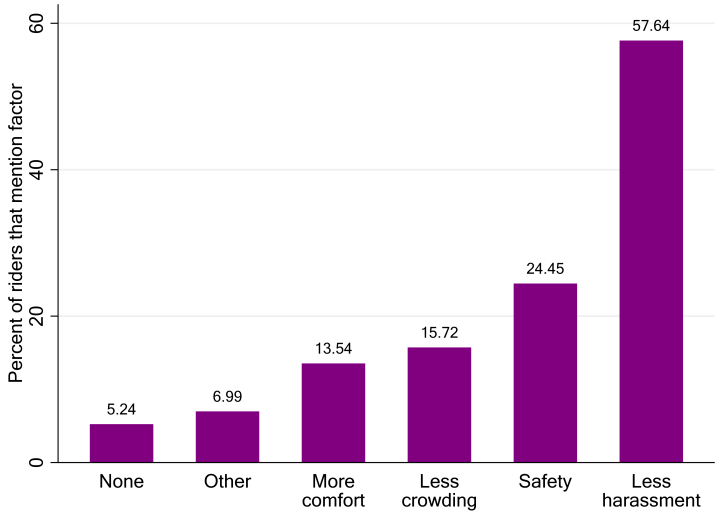
(a) Take-up of reserved space compared to last ride with zero opportunity cost imposed



(b) Number of observations

Note: Sample includes all willingness to pay rides. Displayed values are point estimates and 95% confidence intervals from a regression of take-up of reserved space on dummies the for order in which the rides happened. Omitted ride (take up = 0) is the last ride with no opportunity cost. The ride sequence is defined relative to this ride because not all riders took the same number of rides before moving on to positive opportunity cost rides.

Figure A8: Advantages of reserved space: unprompted responses from participants of rider crowdsourcing



Source: Rider exit survey.

Figure A9: Heterogeneous treatment effects of random assignment to reserved space by "type"

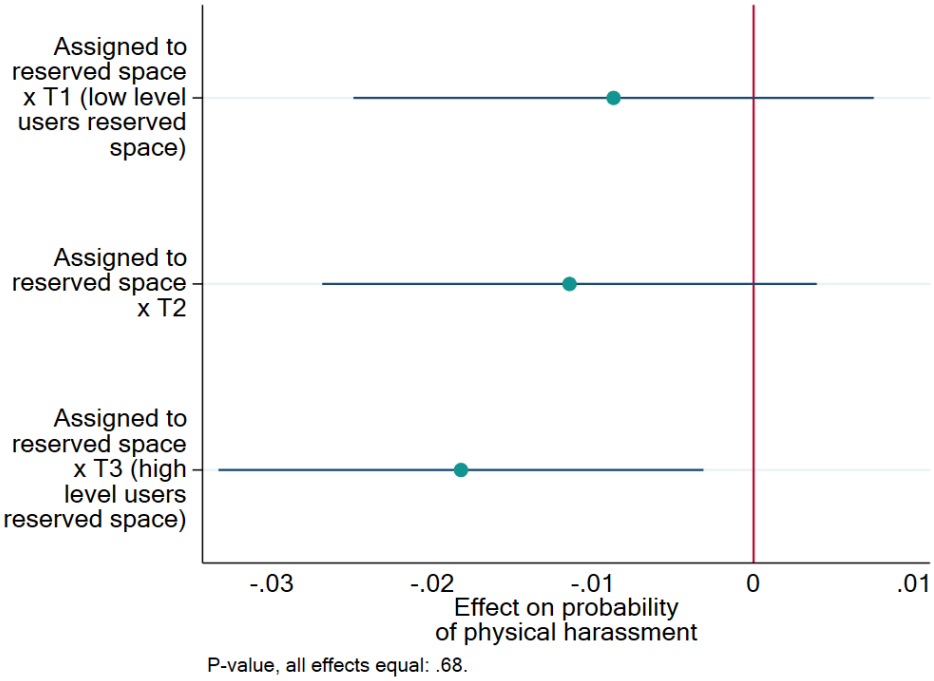
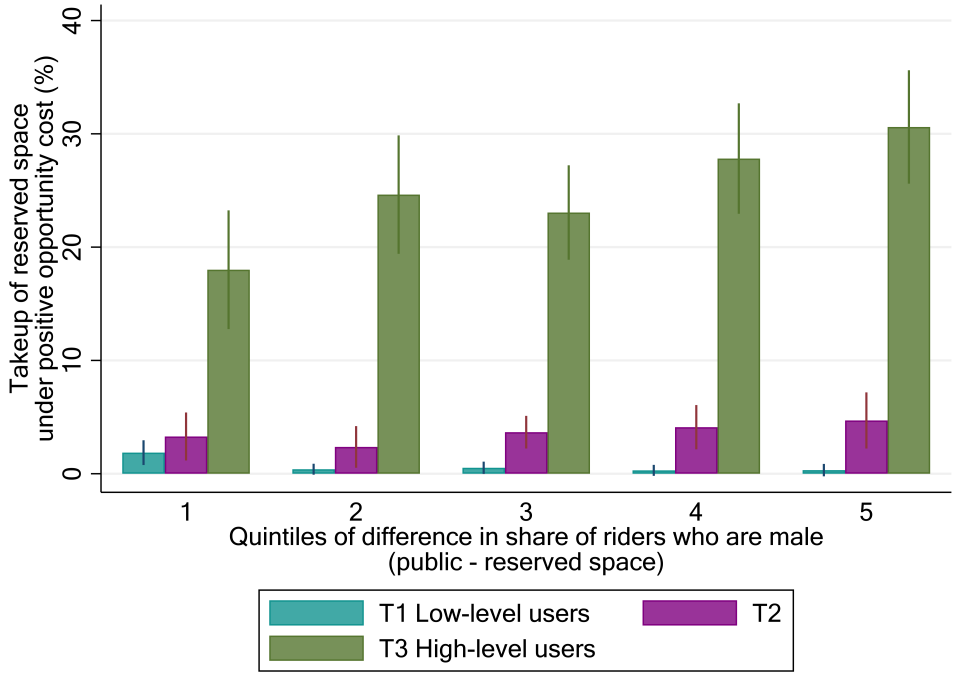
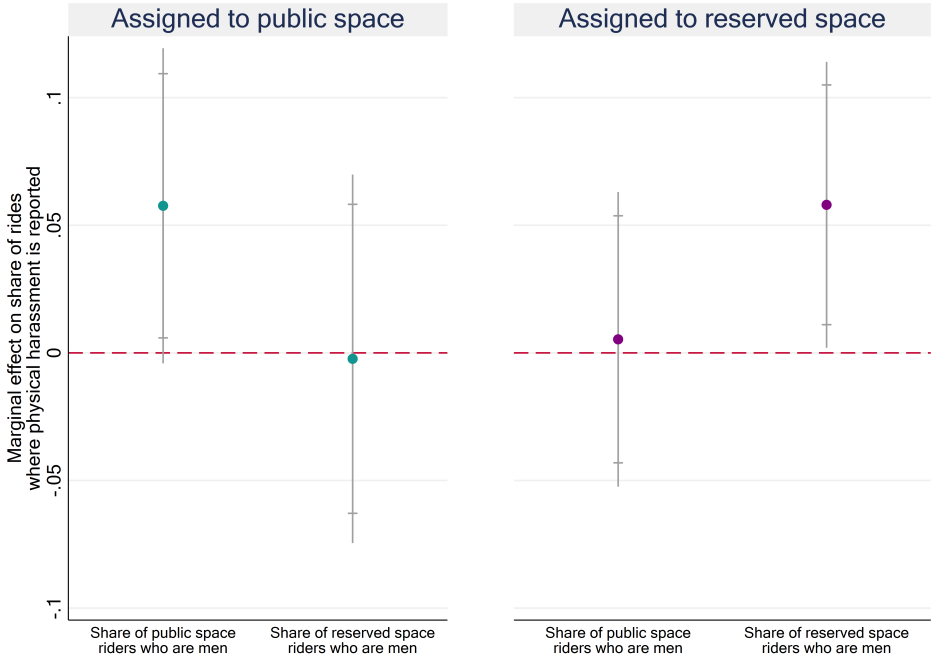


Figure A10: Takeup of the reserved space by "type" across quintiles of presence of men



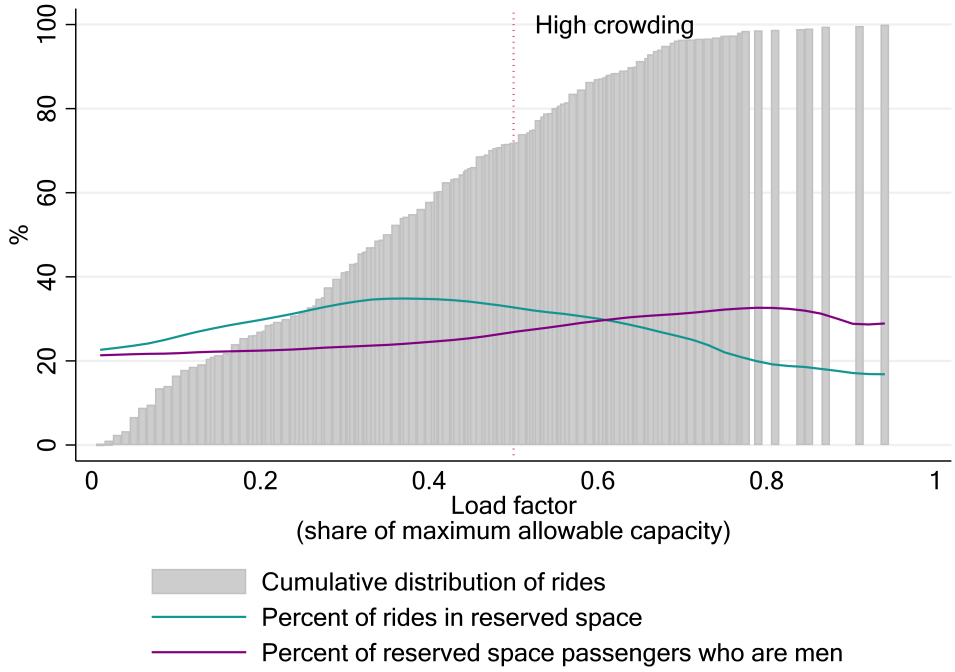
Note: Sample includes respondents who started randomized car assignment rides. Take up bars show predicted values from a regression of choosing reserved space on indicators of quintiles of the differential presence of men between the two spaces. Each series represents a regression for one tercile (high-level users T3, mid-level T2 and low-level T1 users). Standard errors are clustered at rider level. Observations are weighted observations by the inverse of the number of rides taken by the individual rider.

Figure A11: Presence of men in one space does not correlate with harassment in the other space: inconsistent with perpetrator sorting



Note: Sample includes randomized car assignment rides of users with corresponding platform observations, and excludes 3 riders who are outliers on number of harassment occurrences reported. Values shown are point estimates and 90% and 95% confidence intervals for a regression of occurrence of physical harassment on male presence in both spaces at the time of check-in. Regressions control for high crowding and include Supervia line fixed effects. Standard errors are clustered at rider level and observations weighted by the inverse of the number of rides taken by the individual rider.

Figure A12: Correlation between take-up of reserved space and presence of men



Note: Sample is restricted to rides with zero opportunity cost imposed, assigned to riders who moved on to positive opportunity cost rides.

Table A1: Sample size description

	Panel A: Rider reports			
	Number of riders	% of riders	Total number of rides	Average number of rides per rider
Demographic survey answered	263	72.5		
Rides phase started				
1. Revealed preference	363	100.0	17,591	48
2. Random assignment to reserved space	261	71.9	3,806	15
Exit survey answered	229	63.1		

	Panel B: Platform survey and IAT			
	Women	Response rate (%)	Men	Response rate (%)
Platform survey				
Approached	555		523	
Accepted	500	90.1[1]	448	85.7
Finished	448	89.6[2]	423	94.4
IAT				
Approached	429	85.8	391	87.3
Accepted	163	38.0[1]	170	43.5
Finished	145	89.0[2]	146	85.9

Note: On Panel A, the percent of riders is calculated among riders who started the revealed preference phase.
[1] Among those approached. [2] Among those who accepted.

Table A2: Individual pipeline of rides and payments per for riding public and reserved space per rides phase

Ride phase	Payment for public space task (USD)	Payment for reserved space task (USD)	Median number of rides
Phase 1 - Revealed preference			37
Ride block 1	4.50	4.50	
Ride block 2	4.70	4.50	
Ride block 3	4.55	4.50	
Ride block 4	4.60	4.50	
Ride block 5	4.55	4.50	
Phase 2 - Random assignment to a space			11
Ride block 6	4.70	4.70	

Note: The order in which the ride blocks were offered was the same for all riders. The number of rides per block for blocks 1-5 were scheduled to be 5 rides each, however in practice there is some variation in actual number of rides taken in each block. The assignment of tasks by the app was done on a daily basis, riders are only moved to the next block at the end of that day and once quality checks are performed. In addition, some riders dropped out before finishing a block. Sampling weights are applied in the analysis to adjust for this variation in number of rides.

Table A3: Correlation between platform observations data and rider reports

Platform observations	Rider reports: Share of men in reserved space (1)	Rider reports: High crowding (2)
Average share of reserved space riders who are male	0.636***	
	(0.055)	
High crowding		0.246***
		(0.029)
Constant	0.158***	0.490***
	(0.017)	(0.018)
Observations	4846	20742
Riders	327	363

Note: Unit of observation is one ride. Sample includes all rides and riders with matching platform observations across all study phases. Rider report variables are collected for each ride and reported only with respect to the space chosen by the rider. As a result, column (1) is restricted to reserved space rides. Platform observations are taken on different days, then aggregated by time and line segment to be merged with rides. Standard errors in parentheses, clustered at rider level.

Table A4: Response to platform survey and IAT

	Dependent variable: Responds platform survey	Responds IAT		
	(1)	(2)	(3)	(4)
Female respondent	0.045**	-0.055		
	(0.020)	(0.034)		
Usually chooses reserved space			-0.036	
			(0.050)	
Female family members usually choose reserved space				-0.013
				(0.067)
Constant	0.955***	1.055***	1.000***	0.405***
	(0.020)	(0.034)	(0.000)	(0.103)
Observations	1078	820	393	238
Sample	All	All	Females	Males
Platform FE	Yes	Yes	Yes	Yes
F-test for platform dummies (p-value)	0.000	0.000	0.000	0.436
Sample mean	0.879	0.406	0.380	0.435

Note: Unit of observation is one participant. Sample in column 1 includes all individuals invited to the platform survey. Sample in column 2 includes all individuals who were invited to participate in IAT. Samples in columns 3 and 4 include individuals who were invited to participate in IAT and finished the platform survey. Robust standard errors in parentheses.

Table A5: IAT: Robustness check for priming with survey questions

	Dependent variable: IAT D-Score	
	Advances	Safety
	(1)	(2)
Order: advances IAT; advances questions; safety IAT; safety questions	-0.071	0.046
	(0.065)	(0.064)
Order: advances questions; advances IAT; safety questions; safety IAT	0.033	-0.109*
	(0.056)	(0.063)
Order: safety questions; safety IAT; advances questions; advances IAT	-0.029	-0.059
	(0.056)	(0.058)
Constant	0.256***	0.215***
	(0.038)	(0.042)
(Omitted category: Order: safety IAT; safety questions; advances IAT; advances questions)		
Observations	299	301
Sample mean	0.242	0.177

Notes: Unit of observation is one respondent. Sample in column (1) includes all respondents who completed the Provokes Advances test. Sample in column (2) includes all respondents who completed the Safety test. Robust standard errors in parentheses.

Table A6: Social norms survey

	Women Mean/SE (1)	Men Mean/SE (2)	p-value (1)-(2) (3)
Women in public space are more likely to accept advances	0.408	0.486	0.190
	(0.041)	(0.042)	
Women invite advances then change their minds	0.314	0.347	0.553
	(0.037)	(0.041)	
Women on reserved space are less likely to invite advances then change their minds	0.294	0.362	0.210
	(0.037)	(0.040)	
Physical harassment is frequent on public space	0.472	0.472	0.997
	(0.038)	(0.039)	
Ever chose not to go somewhere due to lack of safety or harassment on Supervia	0.440	0.510	0.191
	(0.037)	(0.039)	
Bystanders rarely intervene when witnessing harassment on public space	0.671	0.458	0.000
	(0.035)	(0.039)	
Bystanders rarely intervene when witnessing harassment on reserved space	0.641	0.506	0.0110
	(0.036)	(0.039)	
Women are partly at fault if harassed on public space	0.217	0.199	0.675
	(0.031)	(0.030)	

Notes: Unit of observation is one respondent. Survey modules were randomly allocated to subsets of platform survey participants to minimize survey length. The number of women respondents for each question varies between 250 and 303. The number of men is between 235 and 302. Sampling weights applied. Robust standard errors in parentheses. [1] Women were asked about their past experiences, while men were asked about their women relatives.

Table A7: Test for order effects in on screen presentation of public / reserved space

	Dependent variable: Chose reserved space	
	(1)	(2)
Reserved space shown first	0.005	-0.008
	(0.010)	(0.020)
Positive opportunity cost		0.014
		(0.021)
Reserved space shown first × Positive opportunity cost		0.013
		(0.022)
Constant	0.068***	0.054***
	(0.011)	(0.018)
Observations	6001	6001
Riders	273	273

Note: Unit of observation is one ride. Sample includes revealed preference rides of riders recruited in the first wave. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

Table A8: Respondent-level correlates of "types"

	(1)		(2)		(3)			T-test	
	T1: Low-level users reserved space		T2		T3: High-level users reserved space			P-value	
Variable	N/[Clusters]	Mean/SE	N/[Clusters]	Mean/SE	N/[Clusters]	Mean/SE	(1)-(2)	(1)-(3)	(2)-(3)
Age 18-25	67	0.284	73	0.301	98	0.327	0.808	0.528	0.755
	[35]	(0.052)	[37]	(0.060)	[42]	(0.044)			
Age 26-30	67	0.119	73	0.274	98	0.235	0.064	0.025	0.599
	[35]	(0.041)	[37]	(0.071)	[42]	(0.043)			
Age 31+	67	0.597	73	0.425	98	0.439	0.041	0.035	0.856
	[35]	(0.058)	[37]	(0.066)	[42]	(0.046)			
Years of schooling	67	12.522	73	13.329	98	12.878	0.165	0.439	0.367
	[35]	(0.391)	[37]	(0.446)	[42]	(0.315)			
Single	68	0.515	78	0.551	104	0.587	0.706	0.429	0.679
	[36]	(0.079)	[37]	(0.065)	[42]	(0.048)			
Employed	68	0.676	78	0.692	104	0.760	0.830	0.168	0.307
	[36]	(0.056)	[37]	(0.053)	[42]	(0.043)			
High self-reported socio-economic status	68	0.088	78	0.090	104	0.125	0.974	0.460	0.424
	[36]	(0.039)	[37]	(0.029)	[42]	(0.031)			
Average monthly household income in census tract	65	3080.136	77	2692.339	103	2734.577	0.245	0.405	0.872
	[35]	(377.935)	[36]	(186.063)	[42]	(225.469)			
Home station crimes / year / 100,000 people	101	1545.080	112	1323.169	112	1292.011	0.040	0.051	0.620
	[38]	(127.419)	[38]	(82.366)	[41]	(70.072)			
Home station violent crimes / year / 100,000 people	101	48.433	112	46.456	112	44.170	0.303	0.018	0.059
	[38]	(1.814)	[38]	(1.482)	[41]	(1.349)			
Home station theft / year / 100,000 people	101	307.821	112	254.343	112	245.993	0.040	0.051	0.596
	[38]	(30.396)	[38]	(20.283)	[41]	(17.978)			

Note: Unit of observation is an individual. Groups are terciles of takeup of the reserved space in the revealed preference experiment, where 1 is the lowest and 3 is the highest takeup. Demographic characteristics (age, education, marital status and employment) are observed for the subsample who responded to the demographic survey; home station characteristics are observed for the full sample of participants. Standard errors are clustered at the level of the participant's home station.

Table A9: Revealed preferences by rider risk perception

	Dependent variable: Chose reserved space								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: By risk type, zero opportunity cost									
High risk perceiver	0.105	0.095	0.089	0.072	0.064	0.064	-0.009	-0.022	-0.027
	(0.036)	(0.035)	(0.033)	(0.033)	(0.032)	(0.032)	(0.047)	(0.048)	(0.047)
High crowding			-0.002			0.008			0.015
			(0.040)			(0.036)			(0.052)
Few men in reserved space			0.088			0.088			0.078
			(0.023)			(0.022)			(0.033)
Constant	0.246	0.249	0.204	0.248	0.252	0.205	0.299	0.304	0.262
	(0.017)	(0.017)	(0.021)	(0.019)	(0.019)	(0.021)	(0.028)	(0.026)	(0.029)
Mean dependent variable | Low risk perceiver		0.246			0.248			0.299	
		(0.009)			(0.009)			(0.015)	
Riders	208	208	208	205	205	205	111	111	111
Line fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Type of perceived risk	Physical harassment	Physical harassment	Physical harassment	Verbal harassment	Verbal harassment	Verbal harassment	Robbery	Robbery	Robbery
Panel B: By risk type and opportunity cost									
$\hat{\beta}_{P_1}$: Positive opportunity cost × High risk perceiver	0.081	0.078	0.073	0.092	0.089	0.088	0.137	0.127	0.106
	(0.015)	(0.015)	(0.015)	(0.018)	(0.018)	(0.019)	(0.029)	(0.031)	(0.025)
$\hat{\beta}_{P_2}$: Zero opportunity cost × High risk perceiver	0.333	0.323	0.326	0.311	0.304	0.308	0.263	0.265	0.262
	(0.030)	(0.030)	(0.030)	(0.026)	(0.026)	(0.026)	(0.034)	(0.034)	(0.035)
$\hat{\beta}_{P_3}$: Positive opportunity cost × Low risk perceiver	0.091	0.093	0.090	0.085	0.088	0.084	0.121	0.127	0.131
	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)	(0.022)	(0.022)	(0.022)
$\hat{\beta}_{P_4}$: Zero opportunity cost × Low risk perceiver	0.250	0.251	0.251	0.246	0.247	0.245	0.308	0.311	0.312
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.030)	(0.029)	(0.029)
Observations	13136	13136	12710	13110	13110	12684	7586	7586	7304
Riders	208	208	208	205	205	205	111	111	111
Control for high crowding	No	No	Yes	No	No	Yes	No	No	Yes
Line fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Type of perceived risk	Physical harassment	Physical harassment	Physical harassment	Verbal harassment	Verbal harassment	Verbal harassment	Robbery	Robbery	Robbery
Post-estimate tests for heterogeneous effects									
By opportunity cost: zero opportunity cost - positive opportunity cost									
High risk perceivers: $\hat{\beta}_{P_2} - \hat{\beta}_{P_1}$	0.253	0.245	0.253	0.219	0.214	0.221	0.126	0.138	0.156
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Low risk perceivers: $\hat{\beta}_{P_4} - \hat{\beta}_{P_3}$	0.159	0.158	0.160	0.161	0.159	0.161	0.187	0.183	0.180
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
By risk perception: high risk - low risk perceivers									
Zero opportunity cost: $\hat{\beta}_{P_2} - \hat{\beta}_{P_4}$	0.084	0.073	0.075	0.064	0.056	0.063	-0.044	-0.046	-0.050
P-value	0.019	0.040	0.034	0.049	0.083	0.052	0.331	0.312	0.273
Positive opportunity cost: $\hat{\beta}_{P_1} - \hat{\beta}_{P_3}$	-0.010	-0.015	-0.017	0.007	0.001	0.004	0.016	-0.000	-0.025
P-value	0.651	0.473	0.403	0.768	0.969	0.878	0.653	0.996	0.459

Note: Unit of observation is one ride. Sample includes rides for riders who completed the exit survey, which included questions on perceived risk. Columns 7-9 include observations for participants who completed a version of the exit survey including perceived risk of robbery (added in a second wave of data collection). Panel A includes only rides with zero opportunity cost imposed. Panel B includes all revealed preference rides. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

Table A10: Impact of randomized assignment of car on subjective well-being

	Dependent variable: Above median on self-reported scale									
	Index	Afraid of harassment	Overall wellbeing	Happy	Sad	Tense	Relaxed	Frustrated	Satisfied	Vs before
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Overall impact of randomized assignment										
Assigned to reserved space	0.014	-0.020	0.045	0.036	-0.046	0.004	0.010	-0.034	0.023	-0.005
	(0.010)	(0.017)	(0.024)	(0.021)	(0.022)	(0.024)	(0.025)	(0.021)	(0.019)	(0.016)
High crowding	0.032	-0.006	0.022	0.067	-0.080	-0.062	0.009	-0.062	0.001	0.021
	(0.018)	(0.039)	(0.035)	(0.037)	(0.041)	(0.045)	(0.046)	(0.049)	(0.034)	(0.023)
Few men in reserved space	0.002	-0.016	-0.025	-0.017	-0.023	0.028	-0.041	0.000	0.006	0.030
	(0.011)	(0.020)	(0.027)	(0.027)	(0.022)	(0.029)	(0.027)	(0.020)	(0.026)	(0.019)
Constant	0.429	0.218	0.293	0.496	0.484	0.404	0.495	0.472	0.402	0.127
	(0.008)	(0.012)	(0.019)	(0.020)	(0.016)	(0.021)	(0.020)	(0.016)	(0.018)	(0.014)
Mean dependent variable | Assigned to public space	0.433	0.210	0.291	0.497	0.468	0.415	0.478	0.481	0.413	0.141
	(0.007)	(0.013)	(0.014)	(0.016)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)	(0.011)
Panel B: Heterogeneous effects by type										
Assigned to reserved space	-0.021	0.003	0.032	0.034	0.012	0.063	-0.064	-0.005	-0.003	-0.026
	(0.019)	(0.032)	(0.044)	(0.041)	(0.042)	(0.035)	(0.040)	(0.033)	(0.037)	(0.028)
Assigned to reserved space × T2	0.044	-0.012	-0.002	0.018	-0.103	-0.095	0.110	-0.054	0.052	0.025
	(0.023)	(0.042)	(0.056)	(0.053)	(0.055)	(0.052)	(0.054)	(0.047)	(0.049)	(0.037)
Assigned to reserved space × T3 (High-level users)	0.064	-0.061	0.046	-0.012	-0.074	-0.083	0.113	-0.033	0.023	0.041
	(0.027)	(0.043)	(0.063)	(0.054)	(0.055)	(0.060)	(0.066)	(0.054)	(0.049)	(0.040)
Observations	3695	3695	3594	3594	3594	3594	3594	3594	3594	3594
Riders	259	259	257	257	257	257	257	257	257	257
Rider fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Unit of observation is the ride. All estimates include controls for high congestion and high presence of men and participant fixed effects. Column 1 dependent variable is an inverse covariance weighted index of the measures in columns 2-10, with negative outcomes reversed such that the index represents a positive outcome. Sample includes randomized car assignment rides for riders who started such rides, and rides with corresponding platform audits. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

Table A11: Adjustment on other margins

	Dependent variable:					
	Wait min	Against traffic	Switched spaces	Moved within space	Boarding time AM (hours)	Boarding time PM (hours)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Revealed preference rides						
Positive opportunity cost	-0.104	0.004	-0.009	-0.003	-0.032	-0.032
	(0.252)	(0.008)	(0.007)	(0.011)	(0.022)	(0.026)
Observations	17072	17525	10759	17591	9308	8283
Riders	363	363	361	363	354	355
Uncontrolled mean when zero opportunity cost	7.720	0.226	0.052	0.504	7.408	6.269
	(0.299)	(0.017)	(0.011)	(0.019)	(0.043)	(0.038)
Panel B: Randomized assignment of space						
Assigned public space	0.071	0.013	0.015	0.040	-0.040	0.011
	(0.370)	(0.012)	(0.008)	(0.017)	(0.026)	(0.038)
Observations	3707	3796	3703	2927	1999	1807
Riders	261	261	259	179	240	250
Uncontrolled mean when zero opportunity cost	7.142	0.325	0.048	0.498	7.399	6.216
	(0.399)	(0.022)	(0.009)	(0.032)	(0.051)	(0.05)

Note: All specifications include rider fixed effects. Unit of observation is one ride. Sample in panel A includes all riders who completed at least one opportunity cost ride. Observations weighted by the inverse of the number of rides taken by the individual rider. Standard errors in parentheses, clustered at rider level.

B Variable Definitions

Table B1: Rider audits: demographic survey

Variable	Definition
Age	Median age in years of the rider's age category when demographic survey was responded
Employed	= 1 if rider had part-time or full-time job when responded to demographic survey
High self-reported socio-economic status	= 1 if rider reported being a member of classes A or B
Low education (middle school or less)	= 1 if highest degree obtained by the rider at the time the demographic survey was responded is middle school or lower
Number of Supervia rides in typical a week	Number of times rider would normally ride the Supervia in a typical week during which they are not taking any app rides
Single	= 1 if rider was not married when responded to demographic survey
Years of schooling	Number of years equivalent to rider's highest level of education when demographic survey was responded
Young (18-25 years-old)	= 1 if rider was between 18 and 25 year-old when responded to demographic survey

Table B2: Rider audits: rides

Variable	Definition
	All rides
Afraid of harassment	= 1 if rider reports being afraid that a stranger might touch them intentionally during the ride in an inappropriate way
Against traffic	= 1 if rider is going in direction to the Central Station at the evening or away from it in the morning
High crowding	= 1 if rider report of share of passengers standing in the car they boarded is above the median
Moved within space	= 1 rider moved inside a car during the ride, but did not switch from public to reserved space or vice-versa
Time - AM	= 1 if ride started during the morning
Time - PM	= 1 if ride started during the evening
Wait time	Time rider spent waiting for the train in the platform (minutes)
Time task opened	Local time at which the ride started

Table B3: Rider audits: rides (cont.)

Variable	Definition
Revealed preferences rides only	
Chose reserved space	= 1 if rider takes up the reserved space during ride
Reserved space shown first	= 1 if option to ride reserved space is on the top of the app screen
Share of reserved space riders who are men	Rider report from the platform before check-in
Opportunity cost of riding the reserved space (USD)	
0 cent opportunity cost	= 1 if there is no difference in pay off for riding the public and the reserved space
5 cents opportunity cost	= 1 if difference between pay off for riding the public and the reserved space is \$0.05
10 cents opportunity cost	= 1 if difference between pay off for riding the public and the reserved space is \$0.10
20 cents opportunity cost	= 1 if difference between pay off for riding the public and the reserved space is \$0.20
Positive opportunity cost	= 1 if opportunity cost of riding the public space larger than zero
Randomized car assignment rides only	
Assigned to reserved space	= 1 if rider is assigned the reserved space for a given ride
Assigned to public space	= 1 if rider is assigned the public space for a given ride
Switched spaces	= 1 if rider moved from reserved to public space, of vice-versa, during a ride
Riders experiences of harassment during ride	
Any harassment	= 1 if any of the three following variables is 1
Physical harassment	= 1 if rider reports being touched intentionally by a stranger during the ride in a way that made them feel uncomfortable
Staring	= 1 if rider reports being stared by a stranger during the ride in a way that made them feel uncomfortable
Verbal harassment	= 1 if rider reports that a stranger made comments during the ride that made them uncomfortable
Above median on self-reported scale	
Overall well-being Happy Sad Tense Relaxed Frustrated Satisfied Versus before	For each feeling, riders are asked: "On a scale from 1 to 10, where 1 is the worst and 10 is the best, how much do you fell [feeling]?" Constructed variable is = 1 if the self-reported level is above the median

Table B4: Rider audits: exit survey

Variable	Definition
	Advantages of reserved space
None More comfort Less harassment Less crowding Safety Other	Open-ended question categorized according to most commonly mentioned factors. Each constructed variable is = 1 if rider's response mentioned factor.
	Number of occurrences of harassment in a year, by type of harassment and car ridden
Physical, public space	"Imagine a woman similar to you who rides the Supervia every day to work on the same commuting route as yours. How often do you think a man would touch her against her will/grope her at some point during a year of commuting, while traveling in the public space?"
Physical, reserved space	"Imagine a woman similar to you who rides the Supervia every day to work on the same commuting route as yours. How often do you think a man would touch her against her will/grope her at some point during a year of commuting, while traveling in the reserved space?"
Verbal, public space	"Imagine a woman similar to you who rides the Supervia every day to work on the same commuting route as yours. How often do you think a man would make unwanted sexual comments during a year of commuting, while traveling in the public space?"
Verbal, reserved space	"Imagine a woman similar to you who rides the Supervia every day to work on the same commuting route as yours. How often do you think a man would make unwanted sexual comments during a year of commuting, while traveling in the reserved space?"
	Share of reserved space rides under hypothetical scenarios
Status quo Current scenario, 30 cents opportunity cost Current scenario, 65 cents opportunity cost No men on reserved space, 30 cents opportunity cost No men on reserved space, 65 cents opportunity cost	Riders are presented with different scenarios for male presence in reserved space and ticket prices by space. They are asked which space they would prefer to ride during they usual commute hours if they had to buy a space-specific ticket. Options "Always ride in public space", "Mostly ride in public space", "Sometimes ride in public space, sometimes ride in reserved space", "Mostly ride in reserved space", and "Always ride in reserved space" are converted to 0, .25, .5, 75 and 1, respectively.
	Rider risk perception
Physical harassment Robbery Verbal harassment	Riders was asked to imagine a woman similar to them who rides the Supervia every day to work on the same commuting route as they do, on the public space. They were then asked about the chance that inside the train different situations would happen to them. The constructed variable *high-risk perceiver* is = 1 for each situation if the response is above the median. Conversely, the *low-risk perceiver* variable is = 1 is the response is below the median.

Table B5: Rider audits: platform observations

Variable	Definition
Percent of passengers who are standing	
High crowding	
Difference in presence of male riders between spaces	Share of reserved space rider who are male - Share of reserved space rider who are male
Share of reserved space rider who are male	
Share of public space riders who are male	

Table B6: Administrative data

Variable	Definition
Load factor	Data from Supervia indicates the share of maximum allowed capacity between every two stations by month, hour of the day, line and direction of travel.
Crimes against property rate at home station	Monthly data on crime and population from Instituto de Segurança Pública do Rio de Janeiro, spatially matched to riders' home station
Crime rate at home station	
Violent crime rate at home station	

Table B7: Platform survey

Variable	Definition
Finished the platform survey	= 1 if respondent did not leave before the end of the interview
Number of platform where survey was conducted	
Responded to IAT	= 1 if respondent accepted to take the IAT
Was invited to take the IAT	= 1 if respondent was randomly selected to take the IAT
	Respondent profile
Age	Median age in years of the respondent's age category
Female family members usually choose reserved space	= 1 if answer to "Which of the Supervia spaces do the women in your family usually ride during their usual rush hour commute?" was either "Always reserved space" or "Mostly reserved". Asked only to male respondents.
Female respondent	= 1 is respondent is female
Low education (middle school or less)	= 1 if respondent's highest degree is middle school or lower
Male respondent	= 1 is respondent is male
Number of Supervia rides in a typical week	Answered only by female respondents
Years of schooling	Number of years equivalent to respondent's highest degree
Young (18-25 years-old)	= 1 if respondent is between 18 and 25 years-old
Respondent is employed	= 1 if respondent has part-time or full-time job
Usually chooses reserved space	= 1 if answer to "Which of the Supervia spaces do you ride during your usual rush hour commute?" was either "Always reserved space" or "Mostly reserved". Asked only to female respondents.

Table B8: Platform survey (cont.)

Variable	Definition
Share of reserved space rides under hypothetical scenarios	
Status quo Current scenario, 30 cents opportunity cost Current scenario, 65 cents opportunity cost No men on reserved space, 30 cents opportunity cost No men on reserved space, 65 cents opportunity cost	Riders are presented with different scenarios for male presence in reserved space and ticket prices by space. They are asked which space they would prefer to ride during they usual commute hours if they had to buy a space-specific ticket. Options "Always ride in public space", "Mostly ride in public space", "Sometimes ride in public space, sometimes ride in reserved space", "Mostly ride in reserved space", and "Always ride in reserved space" are converted to 0, .25, .5, 75 and 1, respectively.
Yearly occurrences of verbal harassment when riding public space	"Imagine an average woman who rides the Supervia every day to work on the same commuting route as yours on the public space. How often do you think she would be subject to unwanted sexual comments by men during a year of commuting?"
Number of occurrences of harassment in a year, by type of harassment and car ridden	
Physical, public space	"Imagine an average woman who rides the Supervia every day to work on the same commuting route as yours on the public space. How often do you think she would be subject to unwanted sexual comments by men during a year of commuting?"
Physical, public space	= 1 if respondent thinks a woman with the same commuting pattern as they have who travels daily using the public space will be touched against her will at least once a month over a year of commuting
Verbal, public space	"Imagine an average woman who rides the Supervia every day to work on the same commuting route as public on the reserved space. How often do you think she would be subject to unwanted sexual comments by men during a year of commuting?"
Verbal, reserved space	"Imagine an average woman who rides the Supervia every day to work on the same commuting route as yours on the reserved space. How often do you think she would be subject to unwanted sexual comments by men during a year of commuting?"
Ever chose not to go somewhere due to lack of safety or harassment on Supervia	= 1 if responded "yes"
Social norms	
Women are partly at fault if harassed on public space	= 1 if respondent does not completely disagree with the statement "If a woman goes on the mixed car and gets harassed, it is partly her fault – she could have chosen the women's car and avoided it"
Women invite advances then change their minds	= 1 if respondent says that at least sometimes women on the Supervia invite advances but later change their minds and say they were harassed
Women on reserved space are less likely to invite advances then change their minds	= 1 if respondent says that women who ride the reserved space are "Much less likely" more or less likely to invite advances but later change their minds and say they were harassed
Bystanders rarely intervene when witnessing harassment on public space	= 1 if answer to "How often do people intervene if they see a woman on the public space being harassed?" is one of "Sometimes", "Rarely", "Very rarely" or "Never"
Bystanders rarely intervene when witnessing harassment on reserved space	= 1 if answer to "How often do people intervene if they see a woman on the reserved space being harassed?" is one of "Sometimes", "Rarely", "Very rarely" or "Never"

Table B9: Platform Survey (cont.)

Variable	Definition
	First and second order beliefs
Own belief	Respondents are first asked how likely they believe women who ride the public space are to accept advances, compared to women who ride the reserved space. They are then asked what men and women believe.
Belief about women	
Belief about women	Constructed variables are = 1 if the response is either "More likely" or "Much more likely".

Table B10: Implicit Association Test

Variable	Definition
D-Score on Gender-Career IAT	Normalized difference in average response times between the "stereotypical" and "nonstereotypical" paired tests for each instrument.
D-Score on Advances IAT	
D-Score on Safety IAT	
Female respondent	= 1 is respondent is female
Finished all IAT instruments	= 1 is respondent has valid scores for the gender-career, the advances and the safety IATs
Male respondent	= 1 is respondent is male

C Ethics

The Duke University IRB reviewed and approved the protocol for all components of fieldwork (IRB number D0190). We took several measures to avoid placing any undue burden or risk on participants.

First, we recruited a sample of women most of whom ride the SuperVia on a regular basis regardless of the study. The total payment was roughly double the cost of a ticket on SuperVia. Thus the payment after covering the cost of the ticket and the time taken to ride would be worth relatively little to a participant who had no other purpose in riding. So participants were already familiar with the SuperVia system, its environment and the segregated space policy.

Second, before proceeding to rides offering positive opportunity cost for riding the reserved space, we reviewed the data and verified that majority of participants of rides with zero opportunity cost had experience riding the public space. In fact, all the participants who continued past the zero cent opportunity cost rides chose the public space on at least some of those rides in the study. In addition, fewer than 2% of participants responding to a question about usual ride space reported that they always choose the reserved space.

Third, participation in each ride opportunity was voluntary, and participants were paid for each ride they completed shortly after completion, regardless of the total number they completed. Thus participants could choose to discontinue participation at any time if they felt uncomfortable. In the revealed preference phase of the experiment, the order of the premia offered to ride in the public space was fixed for each rider, and the same task was offered until completed. In each of these rides, participants were always offered the possibility to ride in the women-reserved space for the same base pay-out as was offered in the initial stage of the experiment. In the randomized assignment phase, the task assignment was independent of previous assigned spaces and a rider's decision to take-up that task.

Fourth, in the phase of the experiment during which riders were randomly assigned to ride in a particular space, participants were asked about whether they experienced any

harassment. In case a respondent reported any harassment, the app directed her to the platform guards to whom she could report harassment incidences on SuperVia, who are trained to respond to these reports, as well as to other resources available in the Rio area.

Finally, for the development of all protocols and sensitive survey questions in the project we took feedback from gender experts at the World Bank and local researchers working on gender related issues to ensure that these were worded appropriately.

D Robustness to Attrition

For ethical as well as logistical reasons, participants were allowed to drop out of our experiment at any point. Participation in each ride opportunity was voluntary and compensation separately. Table A1 presents descriptive statistics on participation patterns of dropouts throughout the sequence of rides. Of the 546 initial participants who tried out at least one zero cent opportunity cost ride, 66.5% continued to rides with positive opportunity cost for riding the reserved space and 48.3% continued to the randomized assignment of reserved or public space. Much of this early attrition is driven by casual participants who experimented briefly with the app at the beginning and then did not continue: conditional on completing five or more rides with zero cent opportunity cost, 84% continue to the opportunity cost rides and 61% to the randomized assignment of space.

We first account for attrition bias originating from early attriters who only completed a few rides in the zero-opportunity cost phase of the experiment. First, we verify that observable characteristics do not jointly explain participation in the different phases of the experiment (Table D1). Second, we estimate a conservative bound our results on willingness to pay by assuming that all participants who tested the app and dropped out would always choose the public space. This is a conservative assumption since attriters are in fact somewhat more likely to choose the reserved space at when there is no opportunity cost. Figure D1 shows the results: over 20% of participants still demonstrate positive willingness to pay for the reserved space, even assuming that none of the attriters do so. We also note that the results presented in the event study graph in Figure A7 provide reassurance, as the treatment effects are remarkably stable even as density of observations decline within each phase of the experiment.

Second, we account for potential attrition bias originating from riders systematically responding to assignment to a given space. First, we simply regress rider's take up of a task on treatment assignment (Table D2). Results confirm that participants did not selectively drop out in response to treatment assignment on any given day. Second, we show that our

results are robust to restricting the analysis sample to the subsample of individuals who completed the entire sequence of activities up to the exit survey (see Online Appendix on Robustness Checks). Under monotonicity assumption on attrition in response to treatment, this is sufficient to conclude that attrition is unlikely to bias our estimates.

Figure D1: Take-up of reserved space by opportunity cost level - lower bounds for attrition

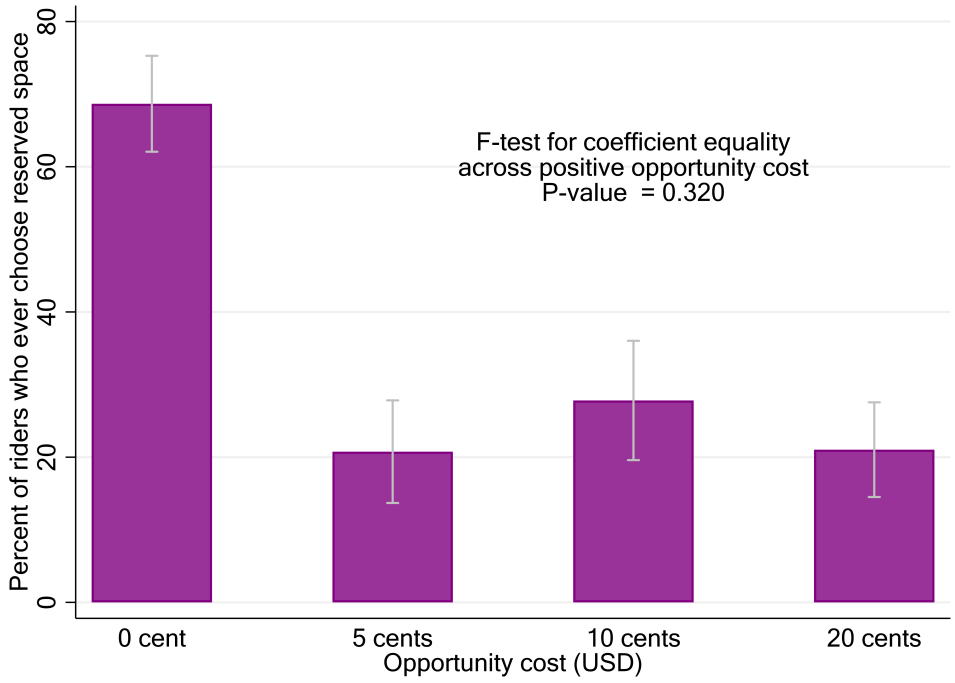


Table D1: Correlates of attrition across phases

	Dependent variable:				
	Started revealed preferences rides		Started randomized car assignment rides		
	(1)	(2)	(3)	(4)	(5)
Low education (middle school or less)	-0.014	0.074*	-0.014	0.074*	0.000
	(0.056)	(0.044)	(0.056)	(0.044)	(.)
Young (18-25 years-old)	-0.067	-0.016	-0.067	-0.016	0.000
	(0.057)	(0.045)	(0.057)	(0.045)	(.)
Single	0.056	0.003	0.056	0.003	0.000
	(0.052)	(0.042)	(0.052)	(0.042)	(.)
Employed	-0.067	-0.032	-0.067	-0.032	0.000
	(0.054)	(0.042)	(0.054)	(0.042)	(.)
High self-reported socio-economic status	0.046	0.042	0.046	0.042	0.000
	(0.078)	(0.061)	(0.078)	(0.061)	(.)
Take-up at zero opportunity cost		0.000		0.000	0.000
		(0.000)		(0.000)	(.)
Any take-up with positive opportunity cost					0.000
					(.)
Constant	0.750***	0.833***	0.750***	0.833***	1.000
	(0.069)	(0.066)	(0.069)	(0.066)	(.)
Observations	371	296	371	296	226
Regression sample mean		0.843		0.843	1.000

Note: Unit of observations is the rider. Sample in columns (1) and (3) include all participants. Sample in columns (2) and (4) are restricted to riders who completed at least 5 zero cent opportunity cost rides. Sample in column (5) includes only riders who completed at least 5 positive opportunity cost rides. Standard errors in parentheses.

Table D2: Effect of random assignment on participation

	Dependent variable: Accepted task	
	(1)	(2)
	Rider-ride	Rider-day
Assigned to reserved space	-0.029*	-0.022
	(0.015)	(0.014)
Constant	0.397***	0.320***
	(0.008)	(0.007)
Observations	5056	4517
Riders	244	244

Note: Unit of observation in column (1) is one rider. Unit of observation in column (2) is one rider-day, and the outcome variable indicates whether the user accepted at least one ride in the day. Standard errors in parentheses, clustered at participant level. All specifications include rider fixed effects.

E IAT

IAT Setup

An IAT is a computerized test originating in psychology to uncover implicit attitudes based on a rapid categorization task (Banaji et al., 2001). An IAT uses the speed with which a respondent sorts items into categories to measure the respondent's strength of association between two ideas. The key assumption underlying any IAT is that the stronger the association a respondent makes between two concepts, the faster they are to make these associations.

The IAT measures an implicit, "gut" reaction, and does not measure behavior, which may be a product of both implicit attitudes and explicit decision-making. While it does not always correlate to considered decisions (Karpinski and Hilton, 2001), it has been found to correlate meaningfully with actions in a range of areas (Poehlman et al., 2009; Greenwald and Nosek, 2015; McConnell and Leibold, 2001), including economically meaningful decisions such as hiring (Rooth, 2010; Reuben et al., 2014), grading (Alesina et al., 2018; Carlana, 2019), voting (Arcuri et al., 2008; Raccuia, 2016), and clinical decisions (Green et al., 2007). As IAT measures typically offer better predictor of behavior than stated attitudes on sensitive topics, it has become ubiquitous in economics (Bertrand et al., 2005; Beaman et al., 2009; Corno et al., 2019; Lowes et al., 2015; Glover et al., 2017).

The respondent sees a series of stimuli, which can be words or images, in the middle of a monitor. At the top of the screen are the two categories in which stimuli need to be sorted with a keystroke to the right or left. Every stimulus has a clear correct category to which it belongs. Each IAT includes several training rounds, a stereotypical ("easy") paired test, and a non-stereotypical ("hard") paired test. In the training rounds, the respondent practices making only one type of categorization. For example in an IAT designed to measure gender stereotypes with regard to career and home tasks, respondents categorize words (e.g., parents or office) into career versus family and pictures of people into male and female. Then, in the

"stereotypical" paired test, a respondent sees the same stimuli, but the categories in which to order them are presented together. The pairs are made to follow the stereotype; women with home and men with career. Stimuli still always fall only in one of the four categories. In the final "nonstereotypical" round, the categories are presented in pairs that are not stereotypically associated (women and career; men and home). This approach assumes that respondents who have a stronger association between the two stereotypical categories (women are associated with home, while men are associated with career) will find it easier to group stimuli in the stereotypical round, compared to the non-stereotypical round. The IAT D-score is the normalized difference in average response times between the "stereotypical" and "nonstereotypical" paired tests (Greenwald et al., 2003).

For this study we developed two sets of IATs to test for associations between the two car types and "safety" and "provokes advances". Table E1 gives an overview of the IATs. We used an identical set of photographs of the women-reserved and public space in both IATs. We selected sets of words for the two tasks that had a similar number of elements, similar length and were all in common daily use in the Rio context; we piloted these with native speakers to eliminate any words that were difficult or ambiguous from either set. We also translated a widely used standard IAT of gender and career IAT as a benchmark.

Each participant who consented to the IAT completed the safety, provocation and career instruments. The order in which a respondent takes the three different IATs is randomized. We implemented the IAT instruments with the software developed by Meade (2009), which calculates the main outcome of interest, the D-score, following the standard methodology in Greenwald et al. (2003).

Table E1: New IAT instruments developed by authors

Round	Categories		Stimuli
	Respond left	Respond right	
Panel A: Safety IAT			
1. Training	Reserved space	Public space	Pictures
2. Training	Seeks safety	Not worried about safety	Words
3. Stereotypical paired	Reserved space Seeks safety	Public space Not worried about safety	Mix
4. Training	Public space	Reserved space	Pictures
5. Non-stereotypical paired	Public space Seeks safety	Reserved space Not worried about safety	Mix
Panel B: Provokes advances IAT			
1. Training	Reserved space	Public space	Pictures
2. Training	Not provoking	Provoking	Words
3. Stereotypical paired	Reserved space Not provoking	Public space Provoking	Mix
4. Training	Public space	Reserve space	Pictures
5. Non-stereotypical paired	Public space Not provoking	Reserved space Provoking	Mix

IAT Results

We test for differences in IAT D-score between the safety and openness to advances IAT, and between men and women. We estimate:

$$Score_{i,j} = \beta_0 + \beta_1 AdvancesIAT_j + \beta_2 WomanRespondent_i + \beta_3 AdvancesIAT_j \times WomanRespondent_i + \epsilon_{i,j} \quad (1)$$

Where the unit of observation is the respondent-instrument (so there are two observations per respondent, one for safety and one for advances); $Score_{ij}$ is the IAT score for respondent i on instrument j, calculated as detailed in Greenwald et al. (2003); $AdvancesIAT_j$ is a

dummy for whether instrument j is the *Advances* instrument, while the $Safety$ IAT is the omitted category; $WomanRespondent_i$ is a dummy for whether the respondent i is a woman; $\epsilon_{i,j}$ is a random error term; standard errors are clustered at the level of the respondent i. The coefficients of interest are β_1, which tests whether respondents associate reserved space choice with openness to advances more or less than with seeking safety, and β_3, which tests whether this difference in associations is stronger or weaker for women respondents. Results are reported in Table E2.

We find that participants may associate women's choice of car more with sexual openness than with concern for safety. However, men seem to perceive less of an association between public space users and openness to sexual advances than women do. The results are robust to train platform fixed effects (Column 3, Table E2). In addition, these IAT results are not driven by a more general gender bias against women working outside the home. Controlling for respondents' D-score on the gender-career IAT does not change our results (Columns 4-6, Table E2).[1]

[1]A positive score on the gender-career IAT indicates that the respondent associates women with home and men with career more easily than the reverse. The gender-career score is significantly correlated with the scores on our IATs, as expected. However, the point estimate on $AdvancesIAT$ is not affected, showing that our results are not driven by this generic association.

Table E2: IAT results

	Dependent variable: Dependent variable: IAT D-Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Advances instrument	0.065	0.110	0.110	0.059	0.105	0.105
	(0.035)	(0.038)	(0.039)	(0.035)	(0.038)	(0.039)
Advances instrument × Male respondent		-0.090	-0.090		-0.093	-0.093
		(0.070)	(0.070)		(0.070)	(0.071)
Male respondent		-0.046	-0.036		-0.022	-0.020
		(0.055)	(0.051)		(0.052)	(0.049)
Employed			0.082			0.048
			(0.075)			(0.059)
Young (18-25 years-old)			0.059			0.058
			(0.044)			(0.043)
Low education (middle school or less)			-0.103			-0.076
			(0.044)			(0.046)
D-Score on Gender-Career IAT				0.225	0.208	0.179
				(0.059)	(0.064)	(0.062)
Constant	0.166	0.189	-0.348	0.106	0.122	-0.424
	(0.027)	(0.040)	(0.076)	(0.030)	(0.041)	(0.074)
Observations	588	588	588	582	582	582
Respondents	294	294	294	291	291	291
Platform Fixed Effect	No	No	Yes	No	No	Yes
Post-estimate test for difference between instruments among men						
$\hat{\beta}$_Advances × Male respondent + $\hat{\beta}$_Advances		0.020	0.020		0.012	0.012
P-value		0.733	0.735		0.836	0.837

Note: The dependent variable is the IAT D-score as calculated by Greenwald et al. (2003). Omitted category is safety instrument in columns (1) and (4); safety instrument, woman respondent in columns (2) and (5); and safety instrument, woman respondent, more than 25 years-old, unemployed, with high school or college degree in columns (3) and (6). Unit of observation is a respondent-instrument pair, so that there are two observations per respondent, one for the provokes advances instrument and one for the safety instrument. Columns (1)-(3) include all respondents who took both the Advances and the Safety tests. Columns (4)-(6) Include only respondents who finished all the tests. All specifications include sampling weights. Standard errors in parentheses, clustered at participant level.

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F Back-of-Envelope Calculations: Cost of Harassment

In this Appendix we interpret our empirical results to provide an estimate of the cost of harassment for those women who commute daily despite the potential for harassment.

Table F1 shows the calculations step by step. We first calculate the average willingness to pay for a ride on the reserved space, by multiplying the takeup at positive opportunity cost (row a) by the opportunity cost (20 cents). We cannot reject that responses to all opportunity cost levels are equal, so participants who show positive willingness to pay on a given ride are assumed to be willing to pay at least 20 cents for those rides. Average willingness to pay is shown on row (b).

We then rescale the willingness to pay for the reserved space, accounting for the fact that it only provides partial protection from harassment. We use the public space mean physical harassment (c) and treatment effect (d) from Table 3); this allows us to calculate the percentage change in row (e). We use this to rescale the willingness to pay:

$$COST_{harassment} = \frac{\mathbf{E}[WTP_{i,t}^{Reserved}]}{\mathbf{E}[Harassment_{i,t}^{Reserved} - Harassment_{i,t}^{Public}]} \tag{6}$$

i.e. row (f) = (b) / (e).

Column 1 assumes that willingness to pay for the reserved space can be attributed to avoiding harassment. Since physical harassment drops by about half when a participant moves to the reserved space (row e), Column (1) row (f.1) implies that the per-ride cost of harassment is twice the value participants place on a ride on the reserved space. This adds up to approximately \$1.46 per incident and \$12 per year, or about 1.7% of the gender wage gap. Based on contemporaneous estimates of the supply elasticity of women's labor in Brazil ranging from 1.2 to 1.5 (Vick, 2017), these estimates would imply a 0.4 - 0.5% decrease in the labor supply of a woman working at minimum wage. We replicate the estimates using the sub-sample in which the reservation rule is most closely followed, i.e. when there are very few men in the reserved space. Column 3 shows these estimates; the results are similar

to Column 1.

To the extent that our revealed willingness to pay measures incorporate other factors than direct incidents of harassment, such as compliance with social norms, Column 1 would over-estimate the cost of harassment per incident. Therefore, we also present an alternative lower-bound approach as a robustness check on our cost calculation. We exploit within reserved space variation in presence of men and the resulting variation in protective value against harassment (Figure 4). We model the relationship between rider i's willingness to pay to ride in the reserved space, their characteristics and the ride conditions in each space as:

$$WTP_{i,t}^{Reserved} = (\alpha_i^{Reserved} - \alpha_i^{Public}) + (X_t^{Reserved} - X_t^{Public})'\beta + \epsilon_{i,t}$$

where α_i^{Space} captures the fixed-amenity value of riding in the *Space* car for rider i (including social norms), $X_{i,t}^{Space}$ is a vector of individual and ride characteristics of interest for rider i commuting in the *Space* car at ride t, and $\epsilon_{i,t}$ is an error term, noting that $\epsilon_{i,t} \geq 0$ since our design presumes $WTP_{i,t}^{Reserved} \geq 0$. Our empirical results demonstrate that the most important component of β is variation in the presence of men, β_{men}, which we assume operates through harassment (Tables 2 and 3); crowding and fear of other crimes do not significantly explain variations in demand for the reserved space (Tables 3 and A9).

To calculate our lower bound estimate of the cost of incidents of harassment, we restrict our attention to β_{men}, the additional value participants place on riding when there are fewer men in the reserved space. This nets out any fixed-amenity value riders experience, such as compliance with social norms.

We compute:

$$COST_{harassment} = \frac{\mathbf{E}[WTP_{i,t}^{Reserved,few\,men} - WTP_{i,t}^{Reserved,many\,men}]}{\mathbf{E}[Harassment_{i,t}^{Reserved,few\,men} - Harassment_{i,t}^{Reserved,many\,men}]} \tag{7}$$

This approach allows us to difference out the $(\alpha_{Reserved} - \alpha_{Public})$ term in (7). This is

analogous to using the difference in presence of men as an instrument for harassment. For this estimate to be consistent, we need to establish a first stage ($\text{Cov}(Harassment, Men_t^{Reserved} - Men_t^{Public}) \neq 0$; Figure 4 and Table 3) and we need to assume exogeneity of the instrument ($\text{Cov}(\epsilon_{i,t}, Men_t^{Reserved} - Men_t^{Public}) = 0$). Column (4) shows the results. The lower bound estimate is approximately 40% of the benchmark estimate in Column 1.

This lower bound estimate suggests that approximately 40% of the value women place on the protective space can be attributed to direct incidents of harassment, while the remainder can be attributed to the fixed-amenity value of the space. The results in Section 7 suggest that this fixed-amenity value, which represents 60% of respondents' revealed willingness to pay, is driven in part by social norms. These results are in line with the fact that willingness to pay for the reserved car when presence of men equalizes across spaces is about 70% of the willingness to pay when presence of men is lower in the reserved space relative to the public space (Figure 4).

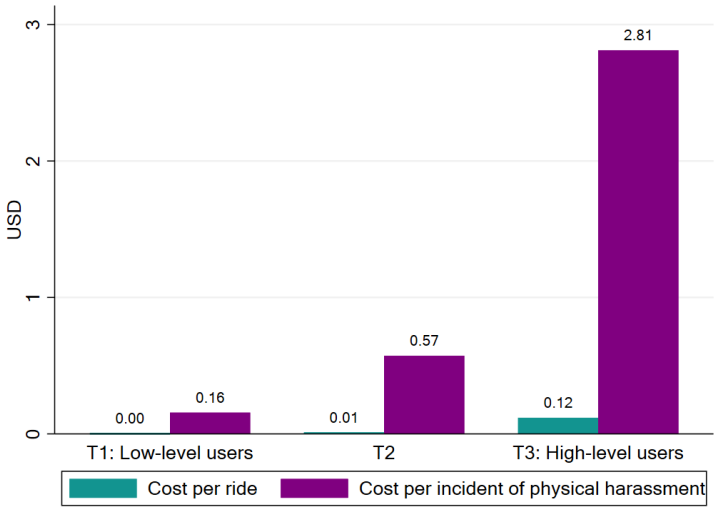
Figure F1 breaks down the Column 1 estimates by women who use the reserved space more or less frequently, as in Section 5.4 and 6.4. The "high-level users" experience an implied cost of 12 cents per ride, and $2.8 per incident, in contrast with $0.16 per incident for the least vulnerable. While these women experience harassment much more frequently, they also value avoiding each incident more. This could be because they experience more serious incidents of harassment, or that they experience a higher cost associated with each incident. The costs of harassment are highly concentrated among this more vulnerable group of women.

Table F1: Back-of-envelope estimates of cost of harassment

	Overall	Men in reserved space		Lower bound cost
		Many men (Q1)	Few men (Q5)	Q5 - Q1
	(1)	(2)	(3)	(4)
a) Take up of reserved space on rides with positive opportunity cost ride	9.25%	7.10%	11.10%	4.00 %
b) Average willingness to pay for reserved space	$ 0.018	$ 0.014	$ 0.022	$ 0.008
c) Average occurrence of physical harassment in public space (% of rides)	2.58%	1.72%	4.49%	1.72 %
d) Change in physical harassment caused by riding reserved space (p.p.)	-1.267	-0.436	-3.336	-2.900
e) Percent change in physical harassment caused by riding reserved space	-49.2%	-25.4%	-74.4%	-49.0 %
f) Cost of harassment				
f.1) Per ride	$ 0.038		$ 0.030	$ 0.016
f.2) Per incident	$ 1.460		$ 0.665	$ 0.949
f.3) Per year	$ 11.84		$ 9.397	$ 5.138
f.4) Percent of minimum wage	0.34%		0.27%	0.15 %
f.5) Percent of gender wage gap	1.67%		1.33%	0.73 %

Note: Male presence is defined by quintiles of difference between share of public space riders who are men and share of reserved space riders who are men. (a) Sample includes only rides from the revealed preference phase of the 261 riders who completed this phase. (b) $= (a) \times 0.20$. We cannot reject that responses to all premia are equal, so participants who show positive willingness to pay on a given ride are assumed to have at least 20 cents willingness to pay for those rides. (c) Corresponds to the mean dependent variable when assigned to public space in columns (3) and (4) of table 3. (d) Column (1) is the coefficient for being assigned to reserved space in panel A, column (3) of table 3; columns (2) and (3) show the $\Delta\hat{\beta}$ when there is a large difference (top quintile) in number of men in reserved space minus women's space; and column (3) when there is a small difference (bottom quintile). Column (4) (a)-(e) show the difference in takeup and protective value against harassment when there is a large versus a small difference in men from moving to the reserved space, i.e. (2) - (3). (e) $= \frac{(d)}{(c)}$. (f.1) $= (b) \times \frac{-100}{(e)}$. (f.2) $= (b) \times \frac{-100}{(c)}$. (f.3) $= (f.1) \times 6.05 \times 52$, where 6.05 is the average number of self-reported weekly rides according to the demographic survey. (f.4) $= \frac{(f.3)}{3455}$, where 3455 is the 2017 annual minimum wage in USD. Source for minimum wage: `https://riotimesonline.com/brazil-news/rio-business/brazils-government-raises-2017-monthly-minimum-wage-to-r937/`. Accessed on Jan 2, 2020.

Figure F1: Distribution of costs of harassment



Note: Graph shows cost estimates calculated as in Table F1 Column 1, dividing participants into terciles by their takeup of the reserved space.