Demand for "Safe Spaces": Avoiding Harassment and Stigma *

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This draft is preliminary and incomplete.

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Abstract

Sexual harassment on a woman's commute is pervasive and widens the gender wage gap. To capture the economic costs of this violence, we randomize the price of a women-reserved "safe space" in Rio de Janeiro. We recruit 357 women riders to crowd-source information on their behavior and experience across 22,000 rides. Women riding in the public space experience harassment once a week. A fourth of riders are willing to forgo the equivalent of a 20% fare subsidy to ride in the "safe space". Randomly assigning riders to the "safe space" reduces the incidence of physical harassment by 50%, implying a low-bound cost of avoiding physical harassment of $1.17 per incident. While the reserved space is safer in relative terms, Implicit Association Tests reveal that commuters associate women riding in the public space with more openness to sexual advances. This stigma may normalize harassment of women in the public space.

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

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1 Introduction

The #MeToo movement highlighted the pervasiveness of sexual harassment and 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). These experiences of harassment are severe, and most women report fearing that street harassment would escalate into violence (Kearl, 2014). The risk of violence might altogether discourage women from market participation (Velásquez, 2019) or from choosing better schools (Borker, 2018).[1] While this literature documents the effects of crime on the extensive margin of women's market participation, they do not capture the recurring and potentially large costs women face when they choose to commute daily.

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.[2] While these reserved spaces may provide an avenue for avoiding harassment (Aguilar et al., 2018), bystanders may *implicitly* view women outside the reserved space as provoking harassment, and assign the responsibility for harassment to the victim. By playing into latent prejudice, these reservation policies may thus induce a stigma against women in the public, non-reserved space, thus reinforcing those same norms that are deleterious to women's safety in the first place (e.g., *"women should not overstep their boundaries"; "to be safe, a woman should stick to her reserved space"*).

We use crowdsourced data from $\approx$ 22,000 rides from 357 daily women commuters Rio de Janeiro's public transit in Brazil to capture the cost of sexual harassment. We elicit revealed preferences for the women-reserved space by varying riders' payouts to ride in different spaces. We then randomly assign riders across spaces to measure differences in the incidence

[1] Limited freedom of movement is a well documented mechanism for gender disparities in economic outcomes such as access to school and training (Muralidharan & Prakash, 2017; Cheema et al., 2017; Burde & Linden, 2013; Jacoby & Mansuri, 2015).

[2] Women-reserved spaces in public transit have been adopted by cities in Brazil, Mexico, Pakistan, India, Bangladesh, Iran, Egypt, the UAE, Israel, Belarus, the Philippines, Malaysia, Indonesia, South Korea, Japan, among others.

of physical harassment. We then use the within-commuter variation in opportunity costs and location generated by these experiments to provide a low-bound estimate of the cost of sexual harassment in public transit. We rule out alternative explanations of women's demand for a women-reserved space (differential crowding, property crime and general fear of crime, time of commute, displacement of crime across spaces). We then administer 948 social norm surveys and 291 Implicit Associations Tests among men and women commuters to document a potential general equilibrium effect of reserved spaces: stigma against women who choose to ride in the public space.

Eliciting revealed preferences establishes that riders place a positive value on accessing a women-reserved space. 26% of riders are willing to forgo the equivalent of 20% of the fare to travel in the reserved space.[3] Randomly assigning riders to either the reserved space or the public space reveal that riders in the public space experience sexual harassment in 17% of rides, of which 20% 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% lower rates of physical harassment relative to the public space. These results are corroborated by self-reports from the survey administered upon completion of all ride tasks, in which 60% of riders report avoiding harassment as the main advantage of the reserved space. These partial equilibrium estimates return a cost of avoiding physical harassment of up to $1.17 per incident. This estimate implies that, over a whole year, experiences of physical harassment would cost an average rider in our sample the equivalent of 0.40% of the minimum wage in Brazil. This is an economically meaningful tax on women's earnings in a context where a woman earns 79.5 cents for every dollar a man earns (IBGE, 2019).

While these results support the notion that women commuters may choose to locate themselves in the reserved space to avoid harassment, these are partial-equilibrium effects of the policy. Indeed, the introduction of a reserved space may have affected riding conditions

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

in the public space, either through displacement or signaling. While this implies that our design cannot isolate the causal effect of creating a safe space on riding conditions, the incidence of harassment in the public space remains the counterfactual of interest for women who are deciding whether to ride in the reserved space in a world where reservation has been introduced. To investigate differences in riding conditions across spaces other than harassment, we deploy a second team of observers to record granular data on crowding and men's presence in the women's space over our entire study period. We also collect information on riders' risk perceptions. These data allow us to rule out systematic differences in crowding or fear of other types of crime such as property crime as alternative mechanisms. We show that sorting of men across spaces does not seem to be driving the results: the share of male riders in one space does not affect occurrence of harassment in the other space.

We next consider a potential general equilibrium effect of the women-reserved space policy: an *implicit* stigma against women riding in the public space. This stigma may reflect back on women's demand for the reserved space in equilibrium and could normalize harassment of women in the public space. Social norms can limit women's participation in market activities. For instance, family members may restrict women's mobility to safeguard their reputation of sexual "purity" (Jayachandran, 2015); (perceived) social norms may restrict women's labour supply (Field et al., 2016; Bursztyn et al., 2018). Accordingly, understanding the impact of introducing a safe space on attitudes towards women using the public space is important for policy.

We interview men and women commuters on the platform and administer 948 social normal surveys and 291 Implicit Association Tests (IATs) to document the stigma women commuters may now face for riding in the public space when they have the choice of a reserved "safe space". Results from our two IATs and social norm survey suggest that male and female respondents *implicitly* and *explicitly* associate women traveling in the public space with sexual provocation. Comparing the two parallel IAT instruments demonstrates that the implicit association between a woman traveling in the public space and sexual provocation

is stronger than the association between a woman traveling in the reserved space and safety. Strikingly, this differential is largest by female respondents. 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. Overall, male and female commuters seem to consider using the women-reserved space as the "proper" choice for a woman commuter. While riding in the reserved space is safer in relative terms, designating a "safe space" may have contributed to normalizing harassment in the public space. These results are particularly alarming, as we show that sorting across spaces becomes difficult at times of high congestion. Understanding these dynamics calls for the urgent need for a body of credible empirical work to advance knowledge of the important question of how to better address sexual harassment in public space.

This study makes three central contributions to the economics literature on crime and gender. First, we generate novel data to quantify the incidence of sexual harassment on transit. While most studies focus on the prevalence of crime, getting at its incidence is essential if we are to capture the cost of a recurring, high-incidence crime such as sexual harassment in public transit (Swim et al., 2001). We set up a high-frequency data generation platform and crowd-source 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, and school choice (Gibbons, 2004; Cullen & Levitt, 1999; Linden & Rockoff, 2008; Besley & Mueller, 2012; Borker, 2018). 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., 2018). We document stark differences across stated and revealed preference approaches, as eliciting stated preferences systematically overstates willingness to pay relative to eliciting revealed

preferences. Third, we move beyond evaluating partial equilibrium effects of "safe space" policies and explore general equilibrium effects through the emergence of a stigma through 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 & Kranton, 2000). Policies going against stereotypes may backlash (Deschamps et al., 2018).

The remainder of the paper proceeds as follows. Section 2 outlines our study context. Section 3 describes the various data generation efforts, while Section 4 presents descriptive findings from the data. Section 5 introduces the revealed preferences results. Section 6 explores mechanisms underlying riders' demand for the reserved space, and provides an estimate of the cost of harassment. Social norm survey and IAT results are presented in Section 7 to test for increased stigma against women riding in the public space. Section 8 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% of female respondents reported ever being sexually harassed while using public transport (Datafolha, 2015).

Issues of sexual harassment on the transit system have led the 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).[4]

Rio de Janeiro's public transit system connects many 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 exten-

[4]Lei Nº 4.733, de 23 de Março de 2006.

sive public transport system that includes bus, metro, a suburban rail, bus-rapid-transit and ferry system. Commutes are long, with a 95 minutes 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 about 10% of all public transport trips in the Rio metropolitan area. Half of Supervia's passengers are women [5] while the women-reserved space accounts for one in eight or one in six carriages, depending on the train length. At peak time, assuming perfect compliance to the reservation rule, one forth to one third of all women riders could ride in reserved space. Male compliance with the reservation rule is enforced by platform officers who also ensure the overall safety of the boarding process. They however do not have policing power, and their presence of these officers varies substantially across stations: it is particularly low in stations located further from central station. This foreshadows substantial differences in compliance to the reservation rule across space and time.

3 Data

We generate two main sources of data. First, we use a crowdsourcing app to collect panel data on sample of regular women commuters and their riding conditions. Second, we administer a platform survey and Implicit Association Tests from a representative sample of male and female commuters. We now detail these data sources.

[5] According to Supervia administrative data.

3.1 Crowd-sourced rider experiences

A sample of riders were recruited to report on their commuting experiences through a smartphone application, for a per-ride payment. Repeated rider reports provide rich within-respondent variation on ride conditions, such as level of crowding and male presence in the reserved and public spaces, experiences (including harassment) and choices. The application allows us to define for each ride the data to be collected, conditions under which to ride and the pay-out. This setup is used to first elicit women commuters' revealed preferences for a reserved space, and understand the drivers of willingness to pay by introducing exogenous variation in which space to ride, while controlling for riding conditions (e.g. crowding and compliance). These are described in Sections 5 - 6. On average riders take a total of 60 rides. We also use the application to collect data on transit conditions throughout the network through platform observers. This provides us with data on the ride environment, unconditional of rider decisions on timing, location and space chosen for their commute. Appendix B describes the measures the research team took to ensure the study followed ethics guidelines.

3.1.1 Rider reports

Recruitment

A total of 357 women 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 app and respond to survey questions regarding their experience with the Supervia. None of the recruitment material mentioned either the issue of harassment or the reserved space. Both men and women applied and gender selection was implemented after sign-up. Recruitment occurred in two waves during February 2016 - February 2017. After sign-up riders were offered both a demographic survey task and the crowdsourcing task. 70% of riders completed the demographic survey (Table

A1). Figure A1 shows that the riders' home location along the Supervia network is spread around the larger metropolitan area, covering rich and poor areas across the entire network. Demographic characteristics of our sample are presented in section 4.

Ride task

Participants are offered a series of tasks which entail riding the Supervia and answer questions before, during and after each ride. Each task specifies the data to collect, location, time frame, and payment for completion. Figure A2(a) 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*). Even though the sub-tasks are priced separately, riders must complete all three sub-tasks and in the right order to receive payment. Total pay-out to complete a ride varies from is \$4.50-\$4.70 per ride.[6] Riders can ride on any weekday between 6-9AM or 5-8PM, up to twice per day (once in the morning, once in the evening) and from any Supervia line and station of their choice. Riders can check available data collection tasks at any time and choose whether or not to take up the offered tasks.

The pipeline is divided in two phases:

1. *Revealed preference*: Riders choose whether to ride in the reserved or public space, first at equal payoffs and later at differential payoffs, to vary the opportunity cost for reserved space.

2. *Assignment to space*: Riders are assigned a specific space (public or women-reserved) for a given payoff. At the of their ride, they are asked questions about their current mental state and well-being as well as any experience with harassment during their ride. This is further described in section 6. Pay-out is equal across assignments.

The same setup is used to both introduce variation in payments for the use of the different spaces and document ride experiences when riders are randomly assigned to ride across the

[6]This payment covers the Supervia transit fare.

different spaces (A2). Each individual is assigned an individual pipeline of specific tasks and all riders are invited to participate in both phases.

In the revealed preference phase, a positive opportunity cost is placed on riding in the reserved space. Upon completion of the check-in task, riders are presented the choice to ride in either the reserved or the public space task for different pay-outs. Total pay-out to complete a ride in the reserved space is $4.50 per ride. An opportunity cost for the reserved space is introduced through an additional pay-out for selecting to ride in the public space. Varying opportunity costs are assigned according to a fixed schedule which is the same for each rider and ranges from zero to $0.20 (Table A2). Each rider take an average of 50 rides in this phase.

In the second phase, riders are offered to complete the task in a specific space. Each rider is assigned a random sequence of spaces across ten rides. The pay-out in this phase is $4.70 regardless of assigned space. Riders take an average of 15 rides in this phase. The screenshots in Figure A2 show how the ride task is presented during each study phase. Riders are not aware of their pipeline nor at they told what number of rides will be offered in each space. More details on each phase of the experiment are provided through sections 5 - 6.

Several quality control measures are taken in both phases. Riders take a photograph of their check-in and check-out station. The app automatically geo-tags and time-stamps each observation when the rider boards and exits the train. 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. Riders are not aware of the number of total rides they will be offered, or of the conditions or payment variation of future rides, minimizing potential for gaming through strategic timing of when to ride.

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, and some declined to answer demographic survey questions. Table A1, panel A, shows the number of riders that progress through each of the study stages. We verify

that assignment to a particular task does not predict drop out and discuss implications for external validity in Appendix C. discusses robustness attrition and verifies that of our results to attrition.

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 rider completes all ride-based tasks, she is invited to take an exit survey, which includes questions on harassment and other topics that could not be included in previous interactions to avoid priming effects. The exit survey includes a set of questions asking for riders' stated willingness to pay for the reserved space, parallel to the revealed preference setup. Finally, we ask about the perceived risk of harassment under different conditions.

3.1.2 Platform observations

A separate group of platform observers collected data on the crowding and enforcement of the gender reservation policy across the system through the same application. Members of this platform observation team stay on the platform and report on both spaces simultaneously. The task specifies where and when to collect the data. All Supervia lines are divided into segments of several stations and further divided by half-hour blocks of the rush hour periods (6-9AM, 5-8PM), in the direction of rush-hour traffic (i.e. in-bound in the morning, out-bound in the evening). Over a period of about three months, the platform observers collected at least three observations from each such half hour-line segment combination. Observers estimated the percent of male riders in a space and report a categorical variable for how many commuters can sit.[7] We generate a binary variable per half hour-line segment for the

[7]The four categories include "All can sit", "Some cannot sit", "Many are standing", "Very crowded".

presence of many men in a space, which is equal to 1 when average male presence in the bin is higher than the system-wide median presence of men in the women-reserved space of 27%. Segments are marked as "High crowding" when the majority of reports indicate the space is "Very crowded".

While riders were also asked to record their ride conditions, their observation are likely affected by their choice or assignment of space. In contrast, the platform observer data is collected by contributors who stay on the platform and observe both spaces simultaneously; thus it is not affected by individual preferences. We confirm that data collected by the platform observation team are strongly correlated with what riders themselves observe on their ride (Table A4).

3.2 Platform Survey and Implicit Association Test

To measure other commuters' attitudes towards women commuting in the public space, we interview a random sample of both male and female commuters, recruited on the Supervia train platform. The survey includes questions on commute behavior, stated preferences and willingness to pay to use the reserved space, perceptions about harassment and norms around female travel. Questions on risk perception, stated preference and willingness-to-pay replicated the question wording in the rider exit survey. To explore alternative drivers of demand for the reserved space, we design and conduct an Implicit Association Test (IAT) among respondents of the platform survey.

To select a representative sample of rush hour commuters, we use a simple sampling protocol based on ordering and counting individuals on the platform at the main station, Central do Brasil. 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. Table A1, Panel B, summarizes patterns of response. A total of 1078 commuters were approached, 555 women and 523 men. Ninety percent (90.1%) of women and 85.7% of men responded to

the platform survey (Table A5 column 1), with an overall response rate of 87.9% [8].

After agreeing to participate in the platform survey, respondents are invited to participate in a IAT. The IAT method and instruments are discussed in Section 7. Participants in the IAT are offered a compensation of R$30.00, or about $7.50.[9] For the application of the IAT we set up a booth close to the platform where the test was taken on a laptop. Table A1, Panel B, shows the patterns of response to the IAT. Conditional on being invited to take the IAT, the response rate was 40.6%. Women are slightly less likely to accept than men (38% versus 43.5%), but this difference is imprecisely estimated (Table A5 column 2). Women's stated use of the reserved space is not significantly correlated with response to the IAT (Table A5, column 3). The platform survey was conducted until the target of 300 finished IATs was reached.[10] Similarly, men who report that their family members usually use the reserved space are not more likely to respond to the IAT (Table A5, column 4). For respondents that agree to participate in the IAT we randomize whether the platform survey is taken before or after completion of the IAT to control for priming effects.

3.3 Administrative Data

We obtained administrative data from the Supervia as an alternative measure of crowding. Congestion is measured as the average number of passengers per square meter in a train and summarized in a load factor which is equal to one if the train is at maximum capacity. The estimates are generated by Supervia transport planners, based on simulations from the city's origin-destination matrix and data from the station far e gates. The data is disaggregated by station, hour of day, travel direction and month. We calculate the average load factor on a participant's trip, across all segments traveled based on the check-in and check-out station and the timings of her trip. Figure A3 shows crowding reports from our platform

[8] Among those who accepted to participate, 8% left mid interview to board their train.

[9] 86 platform respondents were not invited to the IAT because they were illiterate, making completion of the task, requiring matching words and pictures, impractical, and 14 were excluded because of disruption due to a samba party on the train platform.

[10] 9 IAT's 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.

observations are correlated with Supervia administrative records. Comparing the platform observations with the administrative records indicate that our measure of "High crowding" corresponds to a load factor of 0.5 or more.

4 Descriptives

The data collected through the riders and platform respondents provides us with rich information on our participant pool and the typical conditions female commuters face.

4.1 Ride Environment

Overall, the train is densely packed throughout the rush-hour period (Figure A3). The beginning of each rush hour period is the most crowded and patterns are similar across data sources. Half of the Supervia passengers are women[11], but only one in eight or one in six cars is designated as reserved space. As a result we observe that the reserved space is at least as crowded as the public space (Figure A3).

Results from our platform observers confirm that, even though the reserved space is designated for women only, in practice there is a substantial presence of males (Figure A4). The presence of officers enforcing the policy varies substantially by station. Moreover, the cars are connected internally; it is possible for men to move from public to reserved space after boarding, further complicating enforcement. Figure A4 shows the distribution of the proportion of riders who are male by space. The reserved space does have fewer men than the public space, but most times has at least some men. The average proportion of males in the reserved space is 29% compared to 58% in the public space. Comparing male presence across spaces at a given observation shows there is also substantial heterogeneity in the difference male presence a rider faces when deciding which space to use (Figure A5). Compliance with the policy varies by time of day and location. Figure A6 shows compliance is better

[11] According to Supervia reports.

at stations closer to the city center. Figure A7 shows average male presence does not vary much in the morning, whereas it is lower towards the end of the evening rush hour.

4.2 Riders and their experiences

Table 1, Panel A, shows socio-economic characteristics of the riders and platform survey respondent. Column 1 reports characteristics of our crowdsourcing app users. Most participants are regular commuters: about 70% are employed, and the average participant rides the Supervia 6.4 times a week. Unemployed participants are the minority, but are over-represented in the riders sample relative to the representative platform sample; this is likely because participation in the app serves as a form of employment or subsidizes their 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 female commuters, but in both groups respondents state they take close to half of their rides in the reserved space. In our revealed preference setting, the average rider takes 34% of her rides on the reserved space when pay-outs for either space are equal (Figure A8). Demographic characteristics have limited power to explain variation in take-up of the reserved space in rides with zero opportunity costs.[12]

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. However, we observe large differences in perceived levels in the same space across samples. For example the perceived risk of verbal harassment in the public space ranges from once a month among the crowdsourced riders to more than twice a month among platform respondents. These differences highlight the challenge of obtaining consistent numbers of overall risk assessments through surveys. Our crowdsourced measures provide a direct measure of incidences in each ride.

[12] We regress take-up of the reserved space on a vector of demographics; the F-test that all coefficients jointly = 0 has P-value 0.75. Results available on request.

5 Do female riders value the women-reserved space?

5.1 Revealed Preference

We elicit revealed preferences from our sample of riders through the crowdsourcing app described above to estimate the value participants place on 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 an opportunity cost for riding in the reserved space, relative to the public space.

The use of incentives to estimate valuation is important because unincentivized stated willingness-to-pay measures may be subject to response biases and often yield internally inconsistent responses (Diamond & Hausman, 1994; Hausman, 2012; Kling et al., 2012). Researchers have experimented with methods in the lab and, more recently, in the field to elicit willingness to pay for privately consumed goods. The simplest approach is a single offer price at which the respondent may choose to purchase the good; in field settings researchers have randomized offer prices over respondents or geographic areas (Lee et al., 2016; Ashraf et al., 2010; Cohen & Dupas, 2010). This approach is easy to understand and incentive compatible; its main disadvantage is that it only gives a single bound on each respondent's willingness to pay, so it is imprecise.[13]

The object of our study, the transit fare, is a purchase that is made on a daily basis. Our crowdsourcing platform allows us to observe a series of these daily decisions for the same respondent while introducing price variation. This design yields within-respondent variation in the choice of ride (reserved space vs public space), while retaining the simplicity and incentive compatibility of the single offer price method. Figures A2a and A2b illustrate this choice as it was presented to riders in the app. All riders start with a series of at least 5 rides for which they are offered a $4.50 pay-out to ride in either the public or the women-reserved

[13] Another option to overcome this limitation is the Becker-DeGroot-Marschack mechanism (BDM) Becker et al. (1964); Ben Yishay et al. (2017); Tobacman et al. (2017); Hoffmann (2009). While the advantage of this procedure is that it is incentive compatible and should yield the exact willingness-to-pay for the good for each individual, it can be difficult to understand through a simple app interface.

space (Figure A2a). 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 put salience on the price difference (Figure A2b). Participants proceeded through a fixed sequence of rides with varying price differentials, shown in Table A2.[14] To limit framing in these first phase rides we do not survey experience of harassment from riders at the end of these rides.

5.2 Results

We use these crowdsourced data to estimate the effect of assigning an opportunity cost to ride in the reserved space on riders' demand for the reserved space. For an individual rider i on ride j, we estimate the following equation:

$$ChoseReservedSpace_{ij} = \beta_0 + \sum_{l=1}^{3} \beta_l 1[OpportunityCost_{ij} = l] + \alpha_i + \epsilon_{ij} \quad (1)$$

Where $ChoseReservedSpace$ indicates whether the rider chose to ride in the reserved space and $OpportunityCost$ is the opportunity cost rider i faced during ride j to do so, with l indexing the three different opportunity costs assigned; the omitted category are the zero opportunity cost rides during which pay-out is equal regardless of space chosen.

All specifications include individual rider fixed effects α_i, such that the effect of the opportunity cost is identified from within-rider variation across rides; standard errors are clustered at the rider level. In all specifications we weight 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.

Results are reported in Figure 1 and Table **??**. At zero opportunity cost, approximately 80% of participants use the reserved space for some of their rides (Figure 1a). Looking at

[14] We randomize whether the reserved or public space option is offered on top in the app. Table A6 shows that this order does not affect the results.

the extensive margin of use, we find that riders use the reserved space for 25% of these zero-opportunity cost rides (Figure 1b). This suggests a preference for the reserved space beyond random sorting, as only 13-18% of the cars (one per train) are women-reserved.

While introducing a positive opportunity cost for riding in the reserved space reduces the proportion of rides in the reserved space, we observe that 26-31 percent of riders still select the reserved space for some of their rides when facing a positive opportunity cost to do so (col 2, Table **??**). The F-stat presented in the two lower panels of Table **??** indicate that, at these opportunity costs, demand for the reserved space is quite inelastic, as willingness to pay does not vary significantly across different opportunity costs. This suggests that for the participants who take up the reserved space at these costs, 20 cents per ride is a lower bound on their willingness to pay.[15]

Riders may respond to our offer of a higher payment to ride in the public space by adjusting their travel plans at other margins. They may choose to travel in the public space but avoiding a route or time with worse crowding. Alternatively, they may only take up the offer at times when the relative cost of riding in the public space is lowest, e.g. when compliance to the reservation rule is low or when crowding is low. This would tend to bias our estimates towards zero. To explore these mechanisms, we estimate (1) controlling for ride conditions and pooling across opportunity costs to increase power. We now estimate:

$$\begin{aligned} ChoseReservedSpace_{ij} =& \beta_0 + \beta_1 1[OpportunityCost > 0] + \gamma_1 HighCongestion_j + \\ & \gamma_2 FewMenInReservedSpace_j + \alpha_i + \epsilon_{ij}, \end{aligned} \tag{2}$$

where $Crowding$ and $FewMenInReservedSpace$ are characteristics of the ride environment measured by the platform observation team at $(time \times location)_j$: the level of congestion and the prevalence of men in the women-reserved space.[16]

[15] In a subsequent phase, participants were assigned to a 60 cent opportunity cost. Unfortunately, a routing error in the app rendered these rides unusable.

[16] We impute platform observation variables to rides using the mean observation for each 30 minute time

Controlling for ride conditions and pooling across opportunity costs does not change the results reported above (Cols 1 and 2, Panel A, Table 2), suggesting that riders do not systematically respond to their assigned opportunity cost by adjusting their ride conditions. We perform additional checks to verify that riders do not respond to the opportunity cost by changing route, travel time, or by switching across or within spaces (Panel A, Table A7). We find small imprecise effects of offering a assigning a positive opportunity cost on the reserved space across all these margins of adjustment.

How much does presence of men in the reserved space affect riders' willingness to pay for the reserved space? We exploit large variation in the presence of men in the women-reserved space to shed light on potential heterogeneity in riders' demand for the reserved space across compliance levels. We estimate a modified version of (2), in which we interact $FewMenInReservedSpace$ with our assignment to a positive opportunity cost to ride in the reserved space. At zero opportunity cost, riders are 7 percentage point more likely to choose the reserved space when the reservation rule is well adhered too and fewer men are present in the reserved space; this represents a 28.8% increase in demand ($p - value < 0.000$; Panel B, Table 2). While this demand response is divided by three when riders face an opportunity cost to ride in the reserved space ($\Delta\hat{\beta} = 0.023, p - value = 0.026$), this change represents a similar increase (29%) in demand relative to the demand for the reserved space when the opportunity cost is positive.

Finally, we acknowledge that compliance to the reservation rule and congestion are likely related. While we could not generate experimental variation to provide a causal interpretation of these co-movements, Figure A9 describes the relationship between crowding and (1) demand for the reserved space, and (2) the share of men is the women-reserved space.[17]

window-line segment combination as indicators for above / below sample median for the whole study period.

[17]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.

We notice that, at low levels of congestion, the share of men in the reserved space is flat, at about 25%. Over the same congestion interval, demand for the reserved space increases steadily with congestion. As congestion passes the 0.4 load factor mark, which applies to 37% 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 concerns 1.2% of rides, riders are simply randomly walking into any car. This suggests that, at extreme levels of congestion, commuters are not able to effectively sort themselves across spaces.

Taken together, these results suggest that, on average, women's demand for the reserved space is closely associated with avoiding men. This value goes to zero as the space ceases to be *de facto* reserved. These results are corroborated by riders' stated valuation of the reserved space: participants reported substantially higher willingness to pay for the reserved space if the women-reservation rule were completely followed (Figure A10). Interestingly, riders who are willing to forgo a payment to ride in the reserved space are less responsive to changes in compliance than others, suggesting that some other mechanisms may be at play.[18]

6 Mechanisms: Why do women value the women-reserved space?

6.1 Avoiding harassment: Experimental assignment to the women-reserved space

Over 80% of the riders in our experiment report avoiding harassment and safety as the for using the women-reserved space (Figure A11). To formally document this mechanism, we run an experiment in which we assign riders the task to ride in either the reserved space or the public space, and ask them about their ride experience.

[18] In focus groups, women noted that harassment can easily be concealed on a crowded car, and shared that they may be judged or not trusted if they complained.

This experiment provides an estimate of the relative incidence of harassment across spaces, and sheds light on avoiding harassment as a mechanism underlying the demand for the reserved space. In contrast with the set up in the previous phase, riders are now only offered one assignment per day for a fixed payment of $4.70 per ride through the same app.[19] Each day a participant could see only whether she had an offer on that day and, if so, which space she was assigned to. Panel C of Figure A2 shows how this task was presented in the app. Each participant was offered several iterations of each car type in a random sequence; participants could not predict their sequence of rides. At the end of each ride, participants were asked to report experiences of harassment on the journey, including whether any stranger "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. Measures taken to ensure human subject protection over the course of this experiment are discussed in B.

Results

We now estimate the effect of randomly assigning riders to either the reserved space or the public space on their self-reported experiences of harassment and emotional state. We estimate the following equation:

$$y_{ij} = \beta_0 + \beta_1 AssignedToReservedSpace + \alpha_i + \epsilon_{ij} \tag{3}$$

Where $AssignedToReservedSpace$ indicates whether rider i was assigned to ride in the reserved space during ride j; all specifications include individual rider fixed effects α_i, and

[19] Pay-out at this stage was fixed at at $4.70 per ride, the highest pay-out from the previous phase, to avoid discouragement or non-participation due to receiving a lower payout than previously possible (see Table A2).

standard errors are clustered at the rider level. We weight observations by $\frac{1}{N_i}$, the inverse of the number of rides taken by the individual rider throughout the assigned-ride exercise; this accounts for variation in participation frequency, which was not fully controlled by the app.

Table 3 shows the effect of moving from the public to the reserved space on harassment. Overall, the incidence of harassment is high: riders assigned to the public space report experiencing some form of harassment (physical, verbal, or staring) in 17% of rides, and physical harassment in 2.6% of rides.

When assigned to the reserved space, riders are 2.6 percentage points less likely to report experiencing any harassment, or a 15.3% reduction on the mean of in the public space (cols 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% reduction on the mean in the public space). The effects on verbal harassment and staring are smaller and imprecisely estimated.

We showed in Section 5 that compliance with the reservation rule is an important determinant of riders' demand for the reserved space. If avoiding harassment is indeed a demand shifter, we should observe that compliance to the reservation rule predicts harassment. We interact $AssignedToReservedSpace$ with a dummy that indicates whether the presence of men in the reserved car at this time on the line segment where the ride took place was above or below median compliance:

$$\begin{aligned} y_{ij} = {} & \beta_1 AssignedToReservedSpace * FewMenInReservedSpace \\ & + \beta_2 AssignedtoPublicSpace * FewMenInReservedSpace \\ & + \beta_3 AssignedToReservedSpace * ManyMenInReservedSpace \\ & + \beta_4 AssignedtoPublicSpace * ManyMenInReservedSpace + \alpha_i + \epsilon_{ij} \end{aligned} \tag{4}$$

Results are reported in Panel B of Table 3. Equation 4 does not include a constant, and the categories are mutually exclusive and exhaustive, so the difference in coefficients,

$\beta_1 - \beta_2$, 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, $\beta_3 - \beta_4$. 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 1.9 percentage points (p-value=0.003) (cols 3-4). This is a reduction of 68% over the mean in the public space.[20] This effect is one third the size and imprecisely estimated when the reservation rule is not well followed.

Taken together, these results suggest that the reserved space offers partial relief from sexual harassment. While we find large reductions in harassment in the reserved space relative to the public space, they reflect partial equilibrium responses to the reservation rule and do not imply that reserving space only for women decreased harassment in the system overall.

One reason why the general equilibrium effect of the policy could differ is that male perpetrators could sort between cars. For example, they might choose the reserved space to seek out more women as victims, or they might choose the public car in the hope of avoiding detection (it may be difficult for a victim of physical harassment in a crowded train to identify which of the men around her is the perpetrator). If this were the case, we should see that even when the reserved and public spaces have the same proportion of men, harassment would differ between the two cars. Table 3, $\beta_3 - \beta_4$, presents a partial test for this. The estimated effects are small and insignificantly different from zero, which is not consistent with sorting of perpetrators. We further show that the presence of men in the reserved space does not affect harassment in the public space, and reciprocally (A14).

A second reason that the general equilibrium effect of the car might differ is that the existence of the reserved space might reinforce a perception that harassment of women in the public space is acceptable, and places the burden on the victim for not choosing the

[20] Table A8 shows being randomly assigned to the reserved space also translates into improved subjective wellbeing on some measures: it reduces fear of harassment during the ride, and riders are more likely to report feeling happy and less likely to report feeling sad and frustrated.

reserved space to avoid it. We turn to this issue in Section 7.

Table **??** shows back-of-the-envelope calculations for the cost of harassment, based on the results of the revealed preference exercise. The reserved space only provides partial protection from harassment. Therefore we provide a benchmark for the cost of harassment by scaling up the value riders place on the women's car accordingly, to account for this partial protection. Because the reserved space provides an escape from physical harassment but we not other forms of harassment (Table 3), participants' revealed preferences for the reserved space shed light on the cost of physical harassment. Thus we use the incidence of physical harassment to estimate the costs.[21] These estimates suggest that the average rider in our sample places a value of $1.17 on avoiding each incident of physical harassment; over a whole year, experiences of physical harassment would cost an average rider in our sample the equivalent of 40% of the minimum wage in Brazil.

Alternative mechanisms

Crowding

If the reserved spaces were less crowded than the public space, women might prefer it simply for greater comfort. However, data collected by the mapping team show that the women-reserved space is at least as crowded as the public space (Figure A9). Qualitative evidence supports this finding: in a focus group, all participants indicated the main disadvantage of the reserved space was the level of crowding, and they would prefer to travel on it if it were less crowded. In an open-ended question on the disadvantages of the reserved space, 20% of riders reported that the car was too crowded or there were too few cars (not reported).

Fear of other crimes

We have to consider the possibility that women might elect to ride in the reserved space

[21] Note that the focus on physical harassment in these estimates results in a *conservative* estimate of costs. This is because the relative reduction in overall harassment levels (physical, verbal and staring) from moving to the reserved space is small, so willingness to pay a certain amount for that small reduction in risk suggests that each incident is very costly.

to avoid exposure to other crimes besides sexual harassment. Qualitative work suggests this is not the case: women in the focus group discussion said that, while they fear attacks and stray bullets 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.

We formally investigate whether a rider's risk perception 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 vs non-sexual crime (e.g., robbery). We interact the assignment to a positive opportunity cost of riding in the reserved space with a rider's self-reported risk perception in (2). The results are reported in Panels A and B, Table 4. The bottom panel reports statistical tests of coefficient equality across the assignment to positive or zero opportunity cost and a rider's level risk perception. Women who are most concerned about physical or verbal forms of sexual harassment are 35-50% more likely to take up the reserved space during zero opportunity cost rides ($p - values < 0.1$; cols 1-6, Panels A and B, Table 4). However, this effect goes to zero when riding the reserved car requires forgoing a payment: while riders' who perceive a higher chance of physical and verbal harassment are more likely to use the reserved space, they are not more likely to forgo a payment to ride in the reserved space than riders who are less concerned about physical or verbal harassment.

In contrast, we do not find robust evidence that riders' perceived risk of a non-sexual crime (robbery) affects their demand for the reserved space ($p - values > 0.3$, cols 7-9, Panels A and B, Table 4).

7 Stigma

We now investigate the possibility that introducing a women-reserved space may have led to an increased stigma against women riding in the public space. Focus group discussions with male commuters returned some qualitative evidence to that effect; participants stated

knowing of attitudes such as "if she's in my [public] car, then she has to accept that I touch her." As women riders are judged for riding "out of bounds", a stigma emerges. This stigma may reflect back on women's demand for the reserved car in equilibrium. To explore the attitudes women face on their daily commute, we design a social norms survey and a pair of Implicit Association Tests. To capture norms in the population of riders that female commuters face, we administer these instruments on a representative survey of male and female commuters sampled from the platform.[22]

Social norms survey

The majority of commuters say they agree with at least one of the statements assigning responsibility to women for avoiding harassment or blaming them for harassment experienced on the public space (Table A9). Figure A12 shows women's and men's own stated beliefs compared to their second order beliefs, i.e. what they think other commuters believe. The distinction between women's own beliefs and their estimation about men's beliefs is striking. About half of women believe that there is no difference in "openness" between women on the women-reserved and the public space; yet the majority of women think men believe that women on the public space are more open.

IAT

An IAT is a computerized test originating in psychology to uncover implicit attitudes based on a rapid categorization task (Banaji, 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 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

[22]The full instruments and details of recruitment and protocol for these instruments are provided in online supplemental material.

it belongs. 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.

It is important to note that 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 & Hilton, 2001), it has been found to correlate meaningfully with actions in a range of areas (Poehlman et al., 2009; Greenwald & Nosek, 2015; Mcconnell & Leibold, 2001), including economically meaningful decisions such as hiring (Rooth, 2010; Reuben et al., 2014), grading (Alesina et al., 2018; Carlana, 2018), 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., 2018; Lowes et al., 2015; Glover et al., 2017).

Each individual IAT includes several training rounds, a stereotypical ("easy") paired test, and a non-stereotypical ("hard") paired test. (Table A10). 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. In the "stereotypical" paired test, a respondent sees a series of stimuli drawn from both the lists used in training rounds 1 and 2. Now the categories in which to order them are presented together. The easy 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. Another training round follows, in which the respondent practices swapping right and left for one category. 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 score is the normalized difference in average response

times between the "stereotypical" and "nonstereotypical" paired tests (Greenwald et al., 2003).

To assess the strength of perceptions of women in the public and reserved spaces, we designed two IAT instruments for our context: the first tests association of the reserved space with safety and a second of the public space with provocation. In both instruments, the participants are asked to classify pictures taken of train carriages into headings for women-reserved and public space. Pictures were taken to clearly 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 group words connoting greater or less consciousness of safety, such as "afraid" or "worried" versus "relaxed" or "oblivious". A positive score suggests that the respondent do associates reserved space with greater consciousness of safety. In the "provokes advances" IAT, participants were asked to classify stimuli to categories that suggest women either being open to sexual advances from men, such as "seductive" and "provocative", versus not open, such as "prissy" and "saintly". Here, a positive score means that the respondent associates users of the women-reserved space with being less provocative, and users of the public space with being more open to advances. Table A15 gives an overview of the design of the IAT instruments, and online supplemental material provides the the full instruments.

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 as a benchmark. Each participant who consented to the IAT completed the safety, provocation and career instruments, allowing us to use within-respondent variation to compare the strength of these associations. 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).

To test for an association in respondents' perceptions between reserved space choice and either the safety or openness to advances concepts, we test for differences in the IAT D-score between the safety and openness to advances IAT overall, and between men and women. We estimate:

$$Score_{ij} = \beta_0 + \beta_1 AdvancesIAT_j + \beta_2 FemaleRespondent_i + \beta_3 AdvancesIAT_j FemaleRespondent_i + \epsilon_{ij} \quad (5)$$

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; $FemaleRespondent_i$ is a dummy for whether the respondent i is female; and ϵ_{ij} is a random error term, 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 female respondents.

IAT results

Figure 2 shows the distribution of the IAT scores by instrument and gender, and Table 5 shows the results of regression estimations with the IAT scores. Both instruments have a mean D-score significantly greater than zero. This implies that respondents associate women in the reserved space with seeking more safety than women in the public space. They also associate women in the public space with being more open to sexual advances than those in the women-reserved space. However, as Column 1 of Table 5 shows, the association with

openness to advances is more pronounced.

Both men and women on average have an IAT score for the "openness to advances" instrument that is positive, showing a perception that women on the public space are open to advances. However, the estimate in column 2 suggests that male participants show less association between public space users and openness to sexual advances than female participants do. We cannot reject that males show a difference between the two instruments.

The IAT results could be driven by a more general gender bias against women commuting to work outside the home. To test this, in columns 4-6, we show the same estimations controlling for the participant's D-score on the gender-career IAT. 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 estimates on $AdvancesIAT$ is not affected, showing that our results are not driven by this generic association.

The results of the IAT could be confounded by priming with survey questions, or by differential fatigue in the instruments. To address this, we randomized the order of blocks of social norms survey questions and the two main IAT instruments. We find that the order in which the respondents take either task does not affect the results (A11).

One alternative explanation for the difference in results between the two IAT instruments is that one instrument was more difficult to understand than the other, making the implicit association more difficult to detect. To assess this, we test whether the time and error rate differ between instruments. While the IAT score is based on the within-participant difference between response speed on the "stereotypical" and "non-stereotypical" trials, here we examine the response only on the training trials. Table A12 shows the results.

Because our study takes place during a period when the policy is already in place, we cannot directly study the causal effect of the policy on stigma. There may be stigma against women in the public space in the absence of such a policy. However, the perception that "it's partially her fault if she is harassed - she could have chosen the reserved space" could not

exist in the absence of a reserved space. Similarly, the *difference* in perceptions of women on the reserved and women's space, detected by our IAT instrument, could only exist if both spaces exist.

8 Discussion

The incidence of sexual harassment is high and its economic costs largely undocumented. These costs can have large effects on the economy if they induce sub-optimal labor force participation choices by half of the population. Empirically measuring the costs of harassment is difficult because we lack secure mechanisms for reporting harassment and because women are unwilling to report when social norms stigmatize them. The solution several countries have adopted to curtail harassment in public space has been to reserve "safe" space for women. Creating a reserved may implicitly place the responsibility on women to protect themselves against harassment. They, and not the perpetrators, are asked to remove themselves from public space. Shifting responsibility to women can lead to perverse social norms' formation by which women who do not use "safe" space can be found "guilty" of sexual provocation.

In this paper, we have used a reserved "safe" space setting to investigate the incidence of harassment and the drivers of the demand for "safe" space. We identify and document two main drivers: avoiding harassment and avoiding stigma. We rule out other drivers like general crime. We contribute to the literature on crime and gender by innovating on access to reporting by providing women a secure platform to report their experiences, experimentally varying tasks to measure differential rates of harassment in public and reserved space, and experimentally varying payouts to measure women's willingness to pay for reserved space. We use high-frequency metro data to understand congestion patterns. Further, we designed and implement social norms surveys and IATs to measure stated and implicit attitudes women face in the Rio transit system. Because we observe a panel of rides overtime and under different conditions for the same women, we can draw a complex picture of choices

and behavior.

The story we draw out of multiple rounds of experiments goes like this. Women face harassment as part of their everyday lives, on average experiencing harassment once a week but witnessing it every day. On their daily commute, they can choose to ride on a public metro car or a women-reserved metro car, but only when congestion allows: reserved cars are only one in six or one in eight cars depending on the train. Women are almost half of the riders and, at peak times, platforms are so busy that they often cannot reach the reserved car, let alone fit in it, even when they want to. Men also choose where to ride, and some ride in the cars reserved for women. Women experimentally assigned to ride in reserved cars experience forty percent less harassment than in public cars. Whether this is the results of displacement or an overall reduction in harassment is not known, but incidence in the two car types mimics the proportion of men present.

This suggests that perpetrators might not select themselves into one or the other car type. When we vary payouts, women are willing, on average, to take a cut in pay to ride in the reserved car. This is a ten percent increase in their metro fare for a forty percent reduction in harassment that corresponds to a price elasticity of 0.25. We rule out that willingness to pay is driven by other security concerns. Instead, a contributing factor may be stigma. Implicit Association Tests on the platform reveal that women face a stigma for riding in the public space. They are judged harshly for riding in public cars – especially so by other women. In other words, the stigma emerging from the creation of a reserved space may partially explain women's demand for it. We conclude that women's revealed willingness to pay is large and economically significant. As such, curtailing harassment grants a commensurate policy response. We argue that reservation policies, while well meaning, might have ambiguous effects on women's welfare: "safe" space might lower the incidence of harassment for women who chose to ride on it, but increase costs for women who do not or cannot make the same choice. In addition to harassment, they now also face stigmatization for being in public space.

References

Aguilar, A., Gutiérrez, E., & Villagrán, P. S. (2018). Benefits and Unintended Consequences of Gender Segregation in Public Transportation: Evidence from Mexico City's Subway System. (pp. 1–37).

Akerlof, G. A. & Kranton, R. E. (2000). Economics and identity. *The Quarterly Journal of Economics*, 115(3), 715–753.

Alesina, A., Carlana, M., Ferrara, E. L., & Pinotti, P. (2018). Revealing Stereotypes : Evidence from Immigrants in Schools. (November).

Anderson, M. L. (2008). Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. *Journal of the American Statistical Association*, 103(484), 1481–1495.

Arcuri, L., Castelli, L., Galdi, S., Zogmaister, C., & Amadori, A. (2008). Predicting the Vote: Implicit Attitudes as Predictors of the Future Behavior of Decided and Undecided Voters. *Political Psychology*, 29(3), 369–387.

Ashraf, N., Berry, J., & Shapiro, J. M. (2010). Can Higher Prices Stimulate Product Use? Evidence from a Field Experiment in Zambia. *American Economic Review*, 100(December), 2383–2413.

Banaji, M. R. (2001). Implicit Attitudes Can Be Measured. In H. L. Roediger, I. Nairne, & A. Suprenant (Eds.), *The Nature of Remembering: Essays in Honor of Robert G. Crowder*.

Beaman, L., Chattopadhyay, R., Duflo, E., Pande, R., & Topalova, P. (2009). Powerful Women: Does Exposure Reduce Prejudice. *Quarterly Journal of Economics*, 4(124).

Becker, G. M., Degroot, M. H., & Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science*, 9(3), 226–232.

Ben Yishay, A., Fraker, A., Guiteras, R., Palloni, G., Shah, N. B., Shirrell, S., & Wang, P. (2017). Microcredit and willingness to pay for environmental quality : Evidence from a randomized-controlled trial of finance for sanitation in rural Cambodia. *Journal of Environmental Economics and Management*, 86, 121–140.

Benjamini, Y. & Hochberg, Y. (1995). Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society*, 57(1), 289–300.

Bertrand, M., Chugh, D., & Mullainathan, S. (2005). Implicit Discrimination. *American Economic Review: Papers & Proceedings*, 95(2), 94–98.

Besley, T. & Mueller, H. (2012). Estimating the peace divdend: the impact of violence on house prices in Northern Ireland. *American Economic Review*.

Borker, G. (2018). Safety First: Perceived Risk of Street Harassment and Educational Choices of Women. (January).

Burde, D. & Linden, L. L. (2013). Bringing Education to Afghan Girls: A Randomized Controlled Trial of Village-Based Schools. *American Economic Journal: Applied Economics*, 5(3), 27–40.

Bursztyn, L., González, A. L., & Yanagizawa-Drott, D. (2018). *Misperceived social norms: Female labor force participation in Saudi Arabia*. Technical report, National Bureau of Economic Research.

Carlana, M. (2018). Implicit Stereotypes: Evidence from Teachers' Gender Bias. *IZA Discussion Paper No. 11659*, (11659).

Cheema, A., Khwaja, A. I., Naseer, F., & Shapiro, J. (2017). Crossing Boundaries: Experimental Evidence on Access Constraints for Women. *CERP Working paper*.

Cohen, J. & Dupas, P. (2010). Free distribution or cost-sharing? Evidence from a randomized malaria prevention experiment. *Quarterly Journal of Economics*, 125(1).

Cohen, M., Rust, R., Steen, S., & Tidd, S. (2004). Willingness-to-pay for crime control programs. *Criminology*, 42(1).

Corno, L., Ferrara, E. L., & Burns, J. (2018). Interaction, stereotypes and performance. Evidence from South Africa. *Institute for Fiscal Studies Working Paper W19/03*.

Cullen, J. B. & Levitt, S. D. (1999). Crime, Urban Flight, and the Consequences for Cities. *Review of Economics and Statistics*, 81(May), 159–169.

Datafolha (2015). Assédio sexual.

Deschamps, P. et al. (2018). *Gender Quotas in Hiring Committees: a Boon or a Bane for Women?* Technical report, Sciences Po.

Diamond, P. A. & Hausman, J. A. (1994). Contingent Valuation: Is Some Number Better than No Number? *Journal of Economic Perspectives*, 8(4), 45–64.

Field, E., Schaner, S., & Moore, C. T. (2016). On Her Account: Can Strengthening Women ' s Financial Control Boost Female Labor Supply?

Gibbons, S. (2004). The Costs of Urban Property Crime. *Economic Journal*.

Glover, D., Pallais, A., & Pariente, W. (2017). Discrimination as a Self-Fulfilling Prophecy: Evidence from French Grocery Stores. *The Quarterly Journal of Economics*, 132(3), 1219–1260.

Green, A., Carney, D., Pallin, D., Ngo, L., Raymond, K., Iezzoni, L., & MR, B. (2007). Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. *Journal of General Internal Medicine*, 22(9), 1231–8.

Greenwald, A. G. & Nosek, B. A. (2015). Statistically Small Effects of the Implicit Association Test Can Have Societally Large Effects. *Journal of Personality and Social Psychology*, 108(4), 553–561.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and Using the Implicit Association Test: I. An Improved Scoring Algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216.

Hausman, J. (2012). Contingent Valuation: From Dubious to Hopeless. *Journal of Economic Perspectives*, 26(4), 43–56.

Hoffmann, V. (2009). Intrahousehold Allocation of Free and Purchased Mosquito Nets. *American Economic Review: Papers & Proceedings*, 99(2), 236–241.

IBGE (2019). Em 2018, mulher recebia 79,5% do rendimento do homem. Accessed: 2019-05-15.

Jacoby, H. G. & Mansuri, G. (2015). Crossing boundaries: How social hierarchy impedes economic mobility. *Journal of Economic Behavior & Organization*, 117(C), 135–154.

Jayachandran, S. (2015). The Roots of Gender Inequality in Developing Countries. *Annual Review of Economics*, (7), 63–88.

Karpinski, A. & Hilton, J. L. (2001). Attitudes and the Implicit Association Test. *Journal of Personality and Social Psychology*, 81(5), 774–788.

Kearl, H. (2014). *Unsafe and Harassed in Public Spaces: A National Street Harassment Report*. Technical report.

Kling, C. L., Phaneuf, D. J., & Zhao, J. (2012). From Exxon to BP: Has Some Number Become Better than No Number? *Journal of Economic Perspectives*, 26(4), 3–26.

Lee, K., Miguel, E., & Wolfram, C. (2016). Experimental evidence on the demand for and costs of rural electrification. *NBER Working Paper 22292*.

Linden, B. L. & Rockoff, J. E. (2008). Estimates of the Impact of Crime Risk on Property Values from Megan's Laws. *American Economic Review*, 98(3), 1103–1127.

Livingston, B. (2015). *Cornell International Survey on Street Harassment*. Technical report.

Lowes, S., Nunn, N., Robinson, J. A., & Weigel, J. (2015). Understanding ethnic identity in Africa: Evidence from the Implicit Association Test (IAT). *American Economic Review*, 105(5), 340–345.

Mcconnell, A. R. & Leibold, J. M. (2001). Relations among the Implicit Association Test, Discriminatory Behavior, and Explicit Measures of Racial Attitudes. *Journal of Experimental Social Psychology*, 37, 435–442.

Meade, A. W. (2009). FreeIAT: An open-source program to administer the implicit association test. *Applied Psychological Measurement*, 33(643), 2003.

Moovit (2018). Facts and usage statistics about public transit in rio de janeiro region, brazil.

Motte, B., Aguilera, A., Bonin, O., & Nassi, C. D. (2016). Commuting patterns in the metropolitan region of Rio de Janeiro. What differences between formal and informal jobs? *Journal of Transport Geography*, 51, 59–69.

Muralidharan, K. & Prakash, N. (2017). Cycling to school: Increasing secondary school enrollment for girls in India. *American Economic Journal: Applied Economics*, 9(3), 321–350.

Poehlman, T. A., Uhlmann, E. L., Greenwald, A. G., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of personality and social psychology*, 97(1), 17–41.

Raccuia, L. (2016). Single-Target Implicit Association Tests (ST- IAT) Predict Voting Behavior of Decided and Undecided Voters in Swiss Referendums. *PLOS One*, 11(10).

Reuben, E., Sapienza, P., & Zingales, L. (2014). How stereotypes impair women's careers in science. *Proceedings of the National Academy of Sciences*, 111(12), 4403–4408.

Rooth, D.-o. (2010). Automatic associations and discrimination in hiring: Real world evidence. *Labour Economics*, 17(3), 523–534.

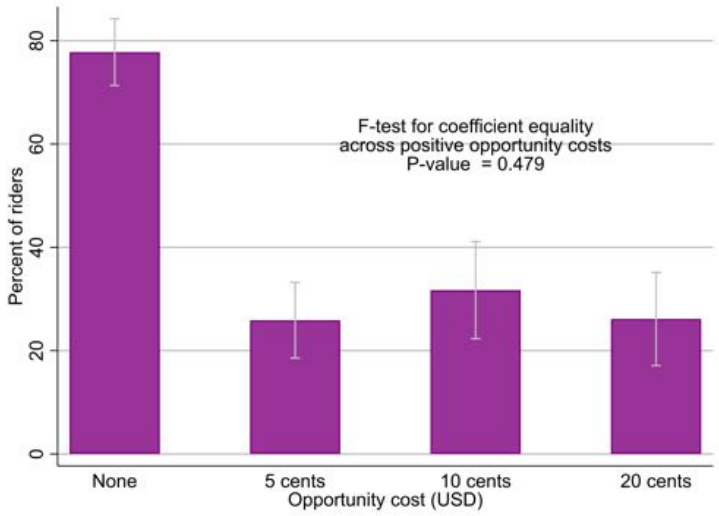
Swim, J. K., Hyers, L. L., Cohen, L. L., & Ferguson, M. J. (2001). Everyday Sexism: Evidence for Its Incidence, Nature, and Psychological Impact From Three Daily Diary Studies. *Journal of Social Issues*, 57(1), 31–53.

Tobacman, J., Stein, D., Shah, V., Litvine, L., Cole, S., & Chattopadhyay, R. (2017). Formal Insurance Against Weather Shocks: Evidence from a Randomized Controlled Trial in India.

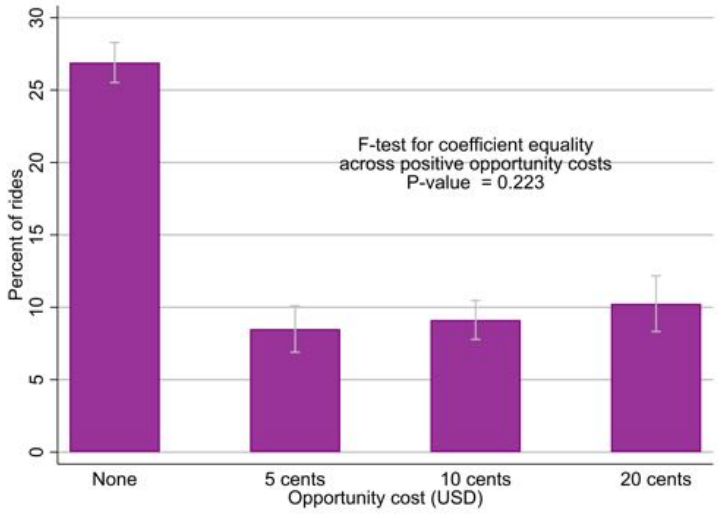
Velásquez, A. (2019). The economic burden of crime: Evidence from mexico. *Journal of Human Resources*, (pp. 0716–8072r2).

Figures

Figure 1: Take-up of reserved space by opportunity cost



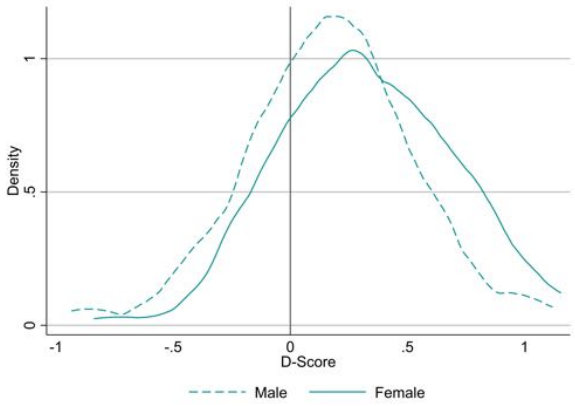
(a) Percent of riders who ever use the reserved space



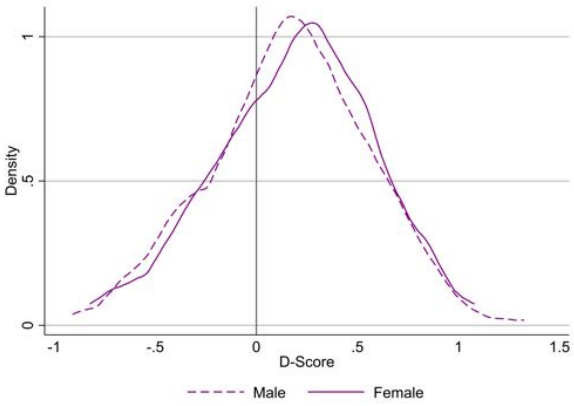
(b) Percent of rides in the reserved space

Notes: Displayed percentages are point estimates from a regression of take-up of the reserved space on dummies for the different opportunity cost levels. Both figures only include 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. Figure (a) observations are at rider / opportunity cost level. Figure (b) observations are at the ride level, comprising 15,614 rides, and estimates include rider fixed effects.

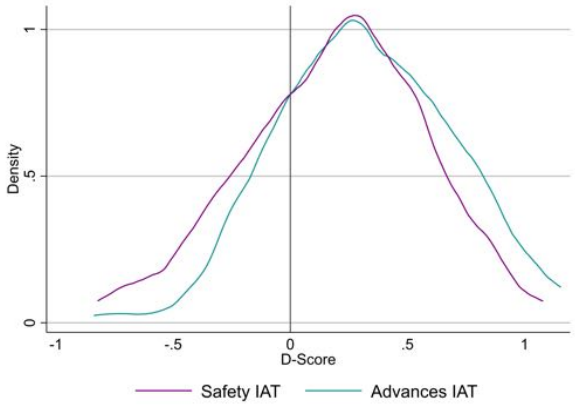
Figure 2: IAT D-Score distribution by test type and gender



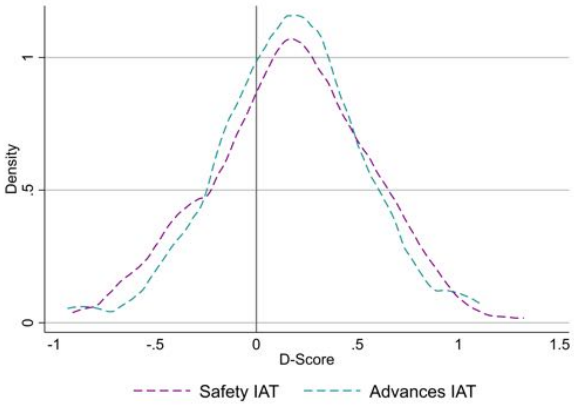
(a) Advances IAT



(b) Safety IAT



(c) Female respondents



(d) Male respondents

Tables

Table 1: Sample description

	Riders Mean/SE (1)	Platform survey: female Mean/SE (2)	Platform survey: male Mean/SE (3)	Difference (2) - (1) (4)	Difference (2) - (3) (5)
Panel A: Demographic variables					
Respondent is employed	0.681	0.913	0.927	0.232***	-0.0150
	(0.025)	(0.018)	(0.017)		
Age	32.58	37.22	36.41	4.642***	0.808
	(0.619)	(0.665)	(0.763)		
Years of schooling	12.93	11.31	11.01	-1.625***	0.304
	(0.187)	(0.277)	(0.241)		
Number of Supervia rides in typical a week	6.055	8.467	8.934	2.412***	-0.467*
	(0.260)	(0.169)	(0.183)		
Crime rate at user home station	1351	1233	1178	-118.772*	54.85
	(38.152)	(48.298)	(42.969)		
Violent crimes at home station	45.30	47.77	46.91	2.473**	0.853
	(0.639)	(0.785)	(0.717)		
Crimes against property at home station	260.3	228.9	214.8	-31.397**	14.08
	(9.225)	(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)	-		

Notes: 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, female respondents were asked to imagine a rider similar to themselves who takes the same commuting route, while male respondents were asked to imagine an average female rider 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. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 2: Revealed preferences, overall and by ride condition

	Dependent variable: Chose reserved space	
	(1)	(2)
Panel A: Overall		
Positive opportunity cost	-0.165***	-0.164***
	(0.010)	(0.010)
High crowding		-0.009
		(0.012)
Few men in reserved space		0.044***
		(0.009)
Constant	0.247***	0.225***
	(0.005)	(0.007)
Mean dependent variable		
Zero opportunity cost	0.243	
	(0.014)	
Panel B: Heterogeneous effects by male presence in reserved space		
Many men in reserved space × zero opportunity cost	0.125***	0.125***
	(0.008)	(0.008)
Many men in reserved space × positive opportunity cost	-0.015***	-0.015***
	(0.004)	(0.004)
Few men in reserved space × zero opportunity cost	0.195***	0.194***
	(0.012)	(0.012)
Few men in reserved space × positive opportunity cost	0.008	0.007
	(0.009)	(0.009)
High crowding		-0.008
		(0.012)
Observations	16889	16889
Riders	363	363
Rider fixed effect	Yes	Yes
Post-estimate tests for heterogeneous effects		
By opportunity cost: zero opportunity cost - positive opportunity cost		
$\Delta\hat{\beta}$ when few men in reserved space	0.187	0.187
P-value	0.000	0.000
$\Delta\hat{\beta}$ when many men in reserved space	0.140	0.140
P-value	0.000	0.000
By male presence in reserved space: few men - many men in reserved space		
$\Delta\hat{\beta}$ when zero opportunity cost	0.070	0.069
P-value	0.000	0.000
$\Delta\hat{\beta}$ when positive opportunity cost	0.023	0.022
P-value	0.026	0.033

Notes: 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. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 3: Impact of randomized assignment of space on reported harassment, overall and by ride condition

	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	-0.026**	-0.026**	-0.013***	-0.013***	-0.008	-0.008	-0.011	-0.011
	(0.013)	(0.013)	(0.005)	(0.005)	(0.007)	(0.007)	(0.012)	(0.012)
High crowding		0.004		-0.010		0.002		-0.001
		(0.029)		(0.013)		(0.011)		(0.027)
Few men in reserved space		-0.005		0.007		0.006		-0.018
		(0.018)		(0.009)		(0.007)		(0.015)
Constant	0.169***	0.171***	0.032***	0.030***	0.059***	0.056***	0.126***	0.135***
	(0.006)	(0.012)	(0.002)	(0.005)	(0.003)	(0.005)	(0.006)	(0.010)
	Mean dependent variable							
Assigned to public space	0.176		0.026		0.067		0.13	
	(0.013)		(0.004)		(0.009)		(0.013)	
Panel B: Impact of randomized assignment by presence of men in reserved space								
Few men in reserved space × assigned to reserved space	-0.016	-0.016	-0.004	-0.004	-0.002	-0.002	-0.018	-0.018
	(0.014)	(0.014)	(0.005)	(0.005)	(0.006)	(0.006)	(0.013)	(0.013)
Few men in reserved space × assigned to public space	0.013	0.013	0.015**	0.015**	0.010	0.010	-0.003	-0.003
	(0.014)	(0.014)	(0.007)	(0.007)	(0.006)	(0.006)	(0.012)	(0.012)
Many men in reserved space × assigned to reserved space	-0.008	-0.008	-0.005	-0.004	-0.004	-0.004	0.004	0.005
	(0.010)	(0.011)	(0.005)	(0.005)	(0.006)	(0.006)	(0.009)	(0.010)
Many men in reserved space × assigned to public space	0.016	0.016	0.000	0.002	0.000	-0.000	0.011	0.011
	(0.012)	(0.013)	(0.005)	(0.005)	(0.006)	(0.007)	(0.011)	(0.011)
High crowding		0.003		-0.011		0.002		-0.002
		(0.030)		(0.014)		(0.011)		(0.029)
	Mean dependent variable							
Assigned to public space × Few men in reserved space	0.145		0.028		0.057		0.099	
	(0.018)		(0.006)		(0.008)		(0.017)	
Observations	3690	3690	3690	3690	3690	3690	3690	3690
Riders	259	259	259	259	259	259	259	259
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								
$\Delta\hat{\beta}$	-0.029	-0.029	-0.019	-0.019	-0.012	-0.012	-0.015	-0.015
P-value	0.082	0.083	0.003	0.003	0.187	0.188	0.341	0.341
Impact on harassment when many men in reserved space: reserved space - public space								
$\Delta\hat{\beta}$	-0.024	-0.024	-0.006	-0.006	-0.004	-0.004	-0.006	-0.006
P-value	0.184	0.184	0.408	0.411	0.733	0.733	0.693	0.694

Notes: 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. * $p < .1$, ** $p < .05$, *** $p < .01$.

Table 4: 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	0.107***	0.097***	0.099***	0.072**	0.065**	0.071**	-0.009	-0.022	-0.016
	(0.036)	(0.035)	(0.034)	(0.033)	(0.033)	(0.033)	(0.047)	(0.048)	(0.048)
High crowding			0.015			0.027			0.045
			(0.045)			(0.042)			(0.062)
Few men in reserved space			0.092***			0.093***			0.083**
			(0.025)			(0.024)			(0.036)
Constant	0.245***	0.249***	0.200***	0.248***	0.251***	0.200***	0.299***	0.304***	0.254***
	(0.017)	(0.017)	(0.023)	(0.019)	(0.019)	(0.023)	(0.028)	(0.026)	(0.032)
Observations	5722	5722	5395	5773	5773	5447	3152	3152	2961
Riders	206	206	206	203	203	203	111	111	111
Line fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Uncontrolled means for omitted categories									
Low risk perceiver	0.245	0.245		0.248	0.248		0.299	0.299	
	(0.009)	(0.009)		(0.01)	(0.01)		(0.015)	(0.015)	
Low risk perceiver, many men in reserved space, low crowding			0.206			0.215			0.249
			(0.023)			(0.026)			(0.031)
Panel B: By risk type and opportunity cost									
Low risk perceiver × zero opportunity cost	0.250***	0.225***	0.230***	0.246***	0.222***	0.226***	0.308***	0.298***	0.301***
	(0.018)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)	(0.030)	(0.036)	(0.036)
Low risk perceiver × positive opportunity cost	0.090***	0.066***	0.064***	0.084***	0.062***	0.056***	0.121***	0.114***	0.120***
	(0.015)	(0.013)	(0.013)	(0.016)	(0.013)	(0.013)	(0.022)	(0.034)	(0.034)
High risk perceiver × zero opportunity cost	0.335***	0.299***	0.312***	0.311***	0.279***	0.293***	0.263***	0.252***	0.258***
	(0.030)	(0.033)	(0.033)	(0.026)	(0.030)	(0.030)	(0.034)	(0.049)	(0.049)
High risk perceiver × positive opportunity cost	0.079***	0.052**	0.053***	0.090***	0.063***	0.069***	0.138***	0.115***	0.095**
	(0.015)	(0.020)	(0.020)	(0.017)	(0.021)	(0.022)	(0.029)	(0.043)	(0.041)
High crowding			-0.027			-0.027			-0.001
			(0.025)			(0.025)			(0.028)
Observations	13213	13213	12544	13187	13187	12522	7657	7657	7305
Riders	206	206	206	203	203	203	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
Post-estimate tests for heterogeneous effects									
By opportunity cost: zero opportunity cost - positive opportunity cost									
$\Delta\hat{\beta}$ for high risk perceivers	0.255	0.248	0.259	0.220	0.216	0.225	0.125	0.137	0.163
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$\Delta\hat{\beta}$ for low risk perceivers	0.160	0.158	0.166	0.162	0.160	0.169	0.187	0.184	0.181
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									
$\Delta\hat{\beta}$ when zero opportunity cost	0.085	0.075	0.082	0.064	0.057	0.068	-0.045	-0.046	-0.043
P-value	0.017	0.036	0.022	0.050	0.081	0.039	0.325	0.310	0.341
$\Delta\hat{\beta}$ when positive opportunity cost	-0.010	-0.015	-0.011	0.006	0.001	0.012	0.017	0.001	-0.025
P-value	0.625	0.471	0.590	0.792	0.965	0.600	0.634	0.976	0.452

Notes: 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 include includes only zero opportunity cost rides. 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. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 5: IAT results

	Dependent variable: Dependent variable: IAT D-Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Provokes 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)
Provokes 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						
$\hat{\beta}_{\text{Provokes advances}\times\text{Male respondent}} + \hat{\beta}_{\text{Provokes Advances}}$		0.020	0.020		0.012	0.012
P-value		0.733	0.735		0.836	0.837

Notes: 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, female respondent in columns (2) and (5); and safety instrument, female 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. *** p < .01; ** p < .05; * p < .1.

A Supplementary figures and tables

Figure A1: Supervia lines and riders home location

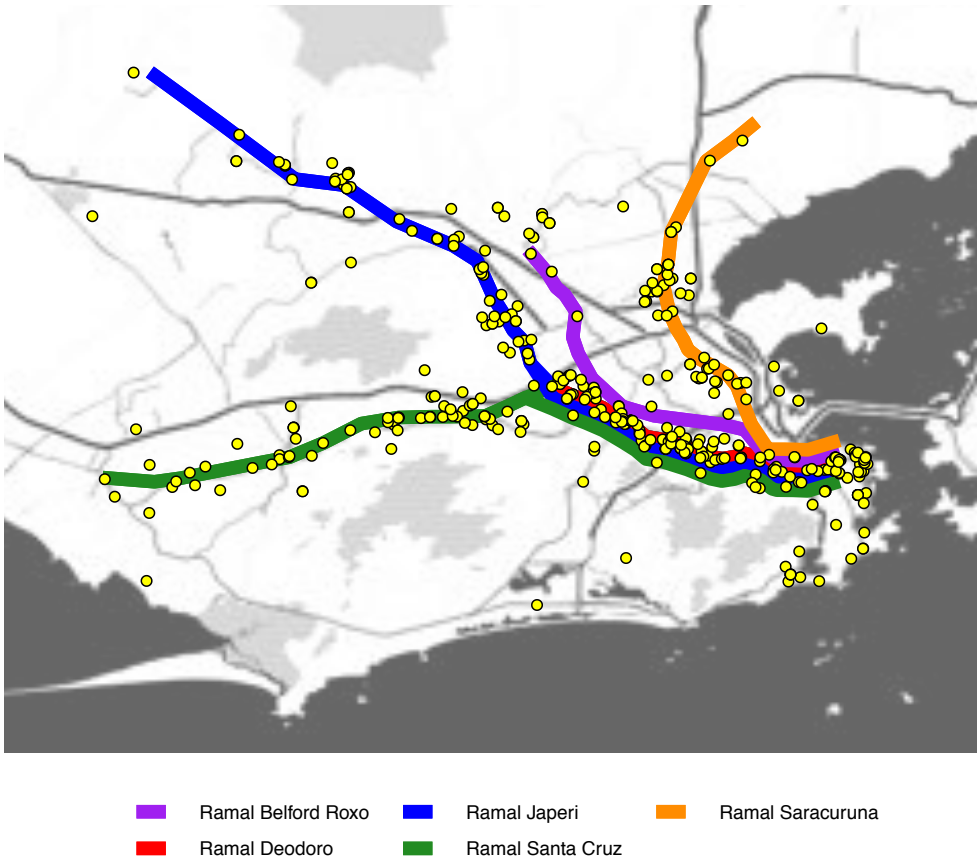
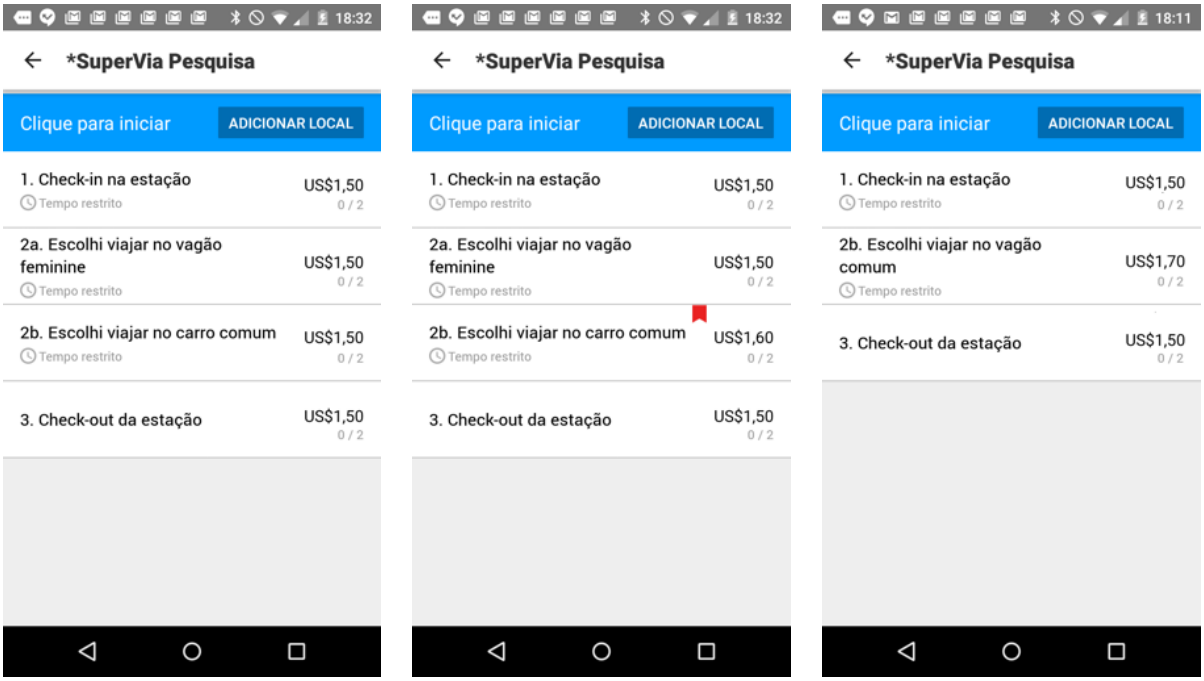


Figure A2: Crowdsourcing app interface across different phases of the study

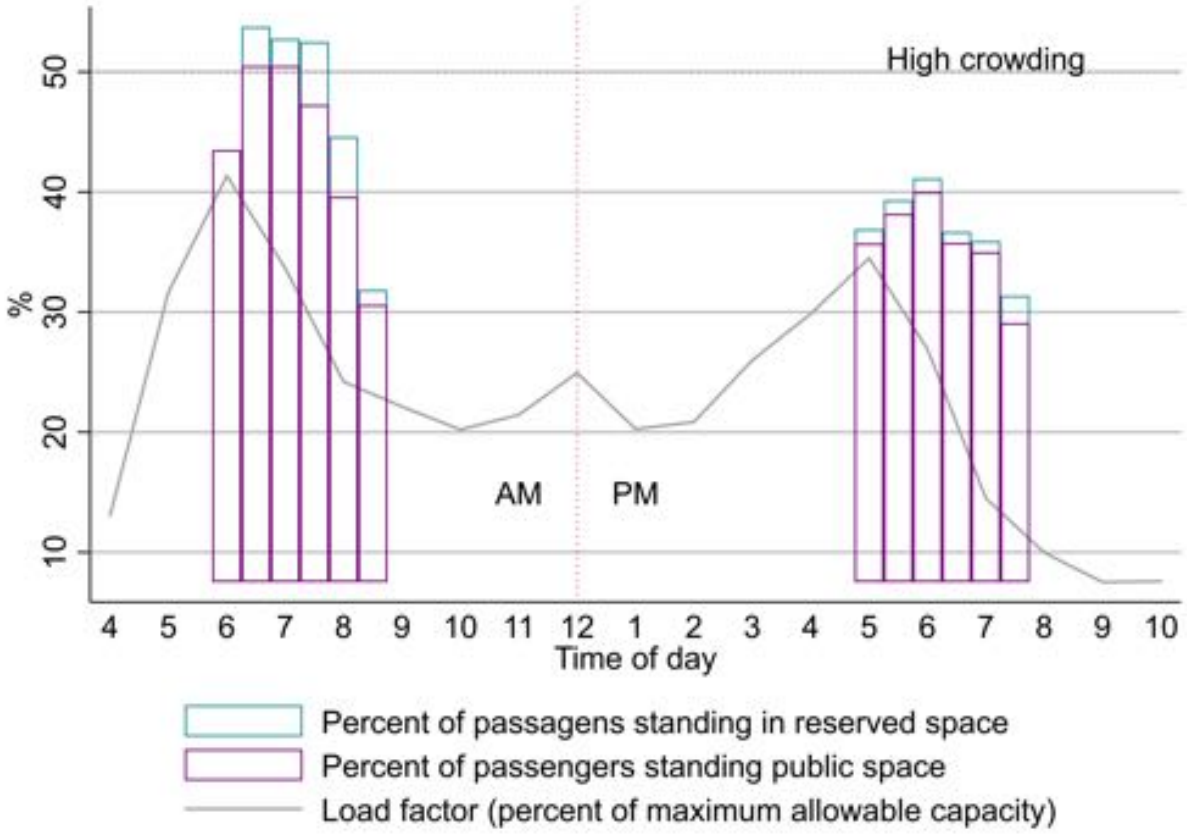


(a) Revealed preference: zero opportunity cost

(b) Revealed preference: positive opportunity cost

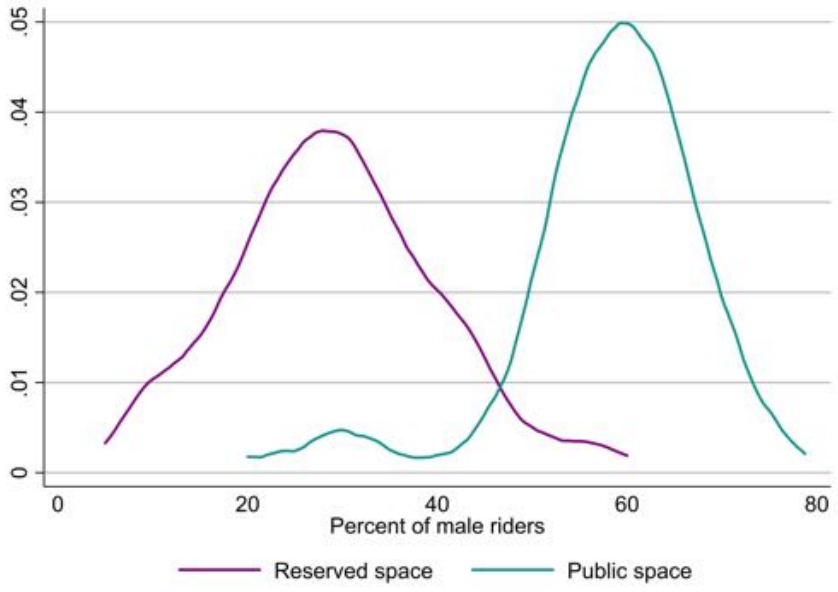
(c) Randomized assignment to space

Figure A3: Congestion in the system by time window



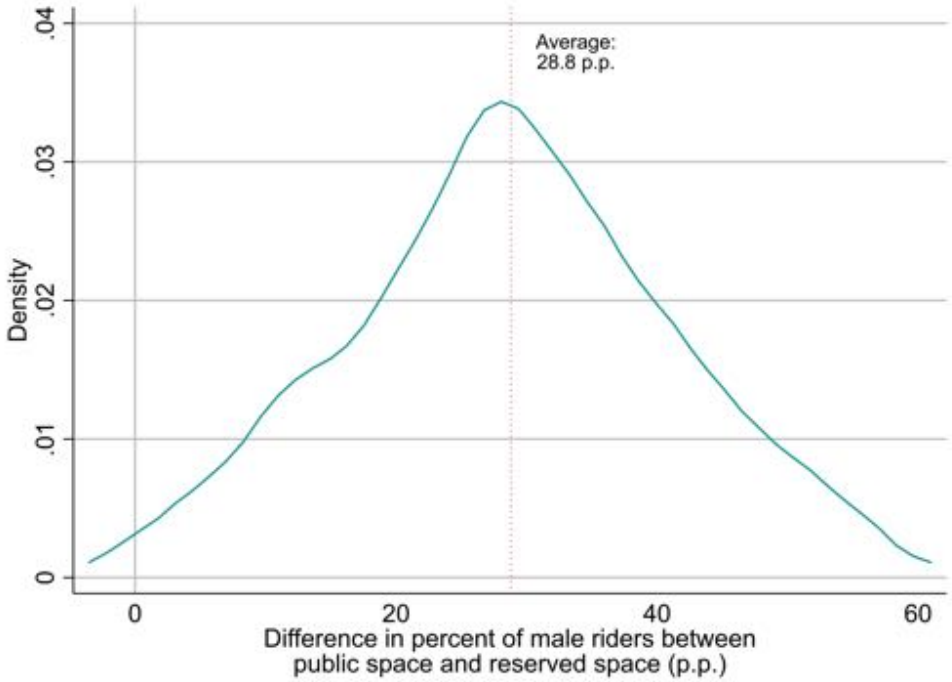
Notes: Congestion in administrative data provided by Supervia is measured as the average number of passengers per square meter in a train, independent of space chosen, between each station. The estimates are generated by Supervia transport planners, based on simulations from the city's origin-destination matrix and data from the station fare gates; we use the averages for September 2015 to November 2016. The platform reports observations from rider study correspond to rush hour windows, when riders could submit ride observations for the study.

Figure A4: Presence of male riders by space



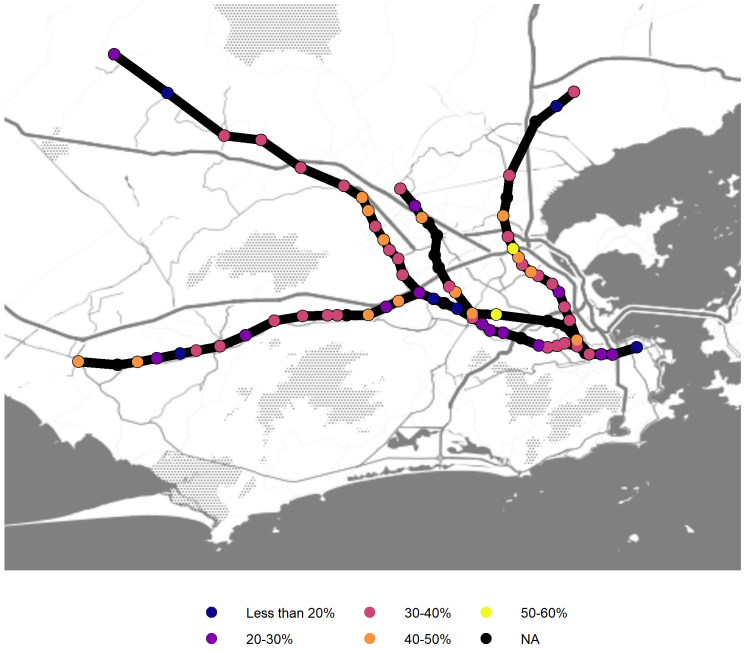
Source: Platform observations.

Figure A5: Difference in presence of male riders between spaces



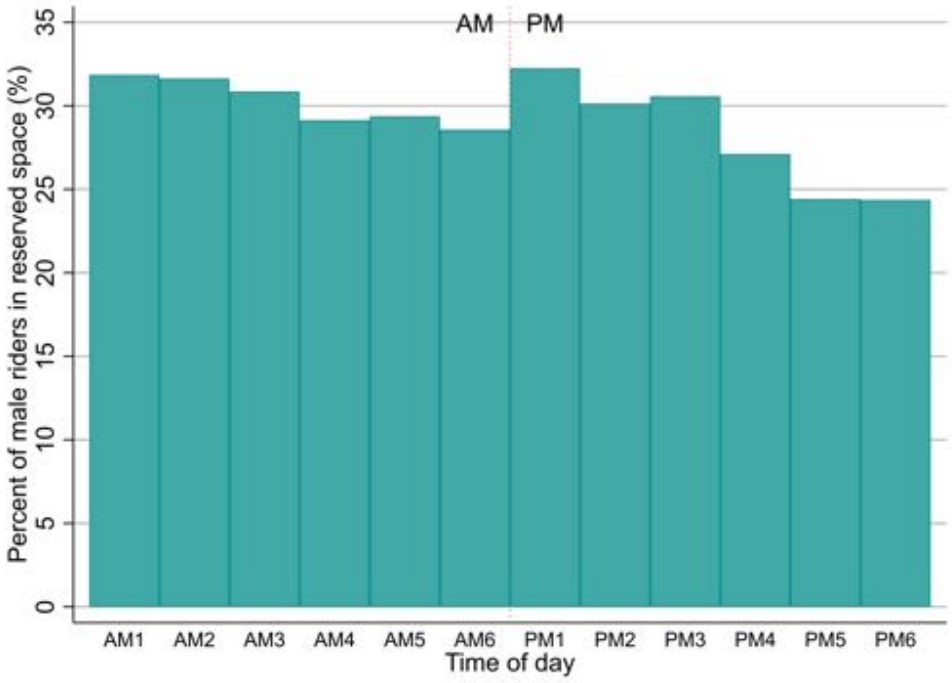
Source: Platform observations.

Figure A6: Presence of male riders in reserved space over stations



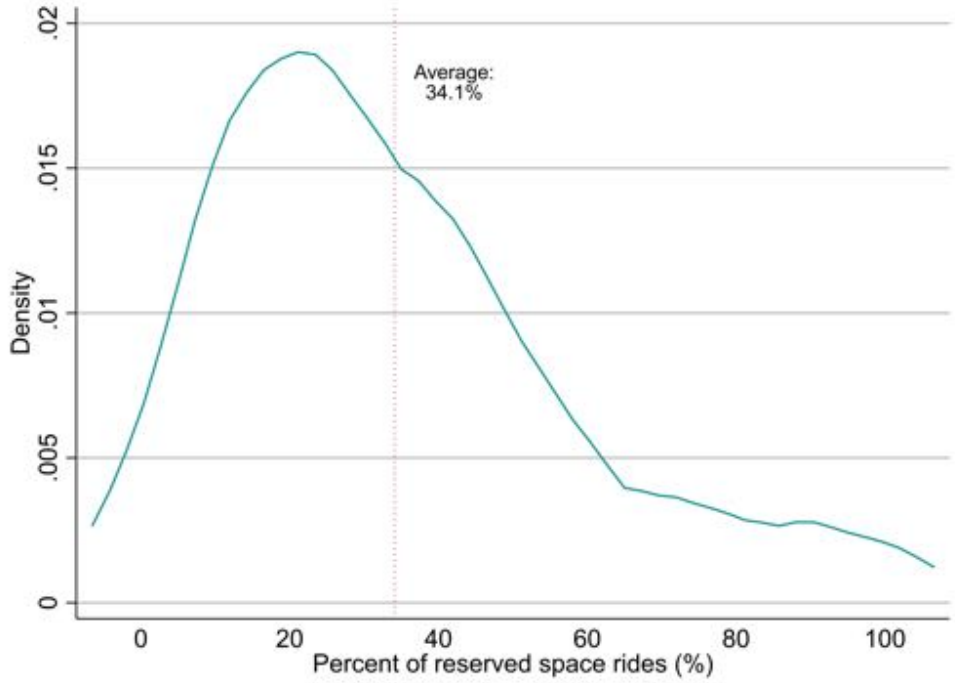
Source: Platform observations.

Figure A7: Presence of male riders in reserved space over time



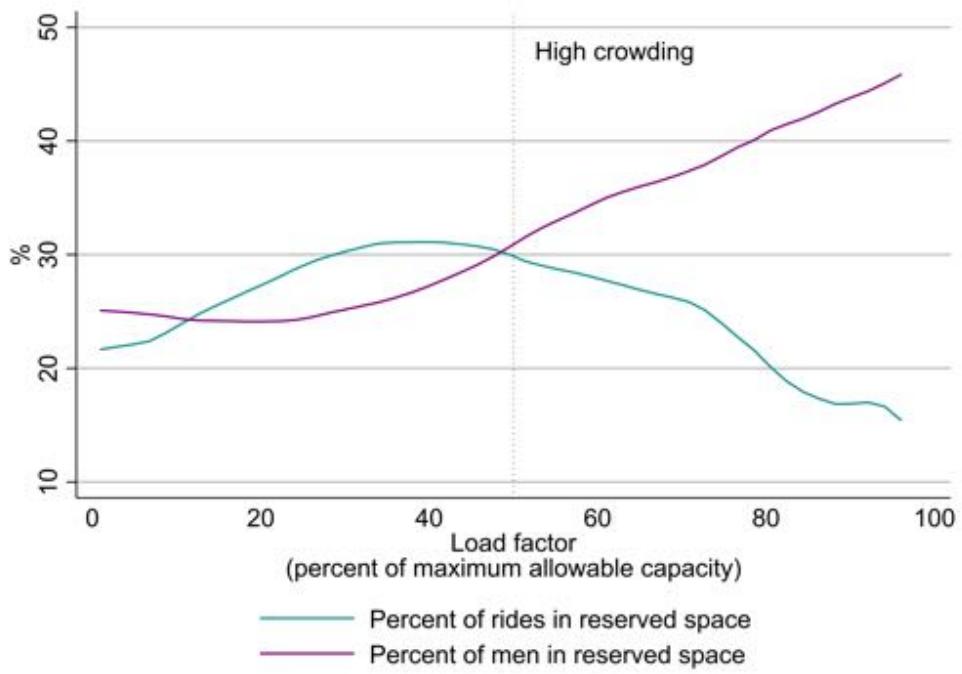
Source: Platform observations.

Figure A8: Distribution of crowdsourced riders' take-up of reserved space under zero opportunity cost



Notes: Only includes revealed preferences rides with zero opportunity cost for riding the reserved space from riders who completed the exit survey and had at least one reserved space ride during zero-opportunity cost rides. Unit of observation is one rider.

Figure A9: Correlation between take-up of reserved space and presence of male riders



Notes: Sample is restricted to zero opportunity cost rides of riders who moved on to positive opportunity cost rides.

Figure A10: Impact of compliance: stated and revealed preference

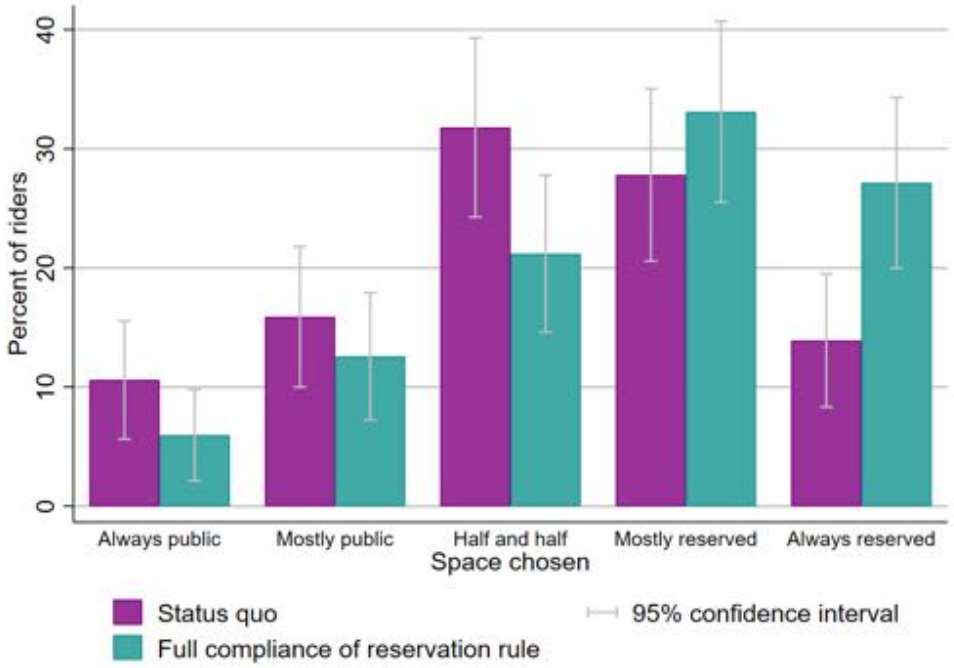


Figure A11: Advantages of reserved space: unprompted responses from participants of rider crowdsourcing

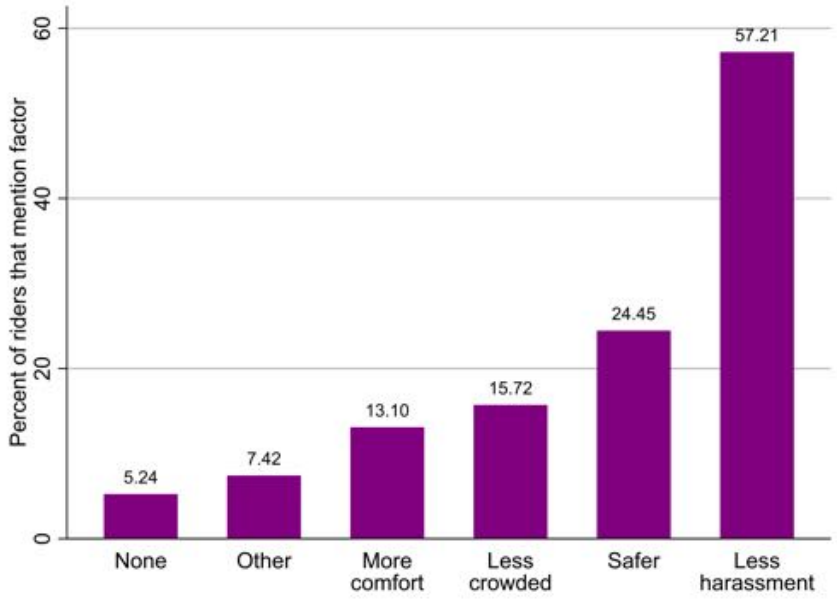
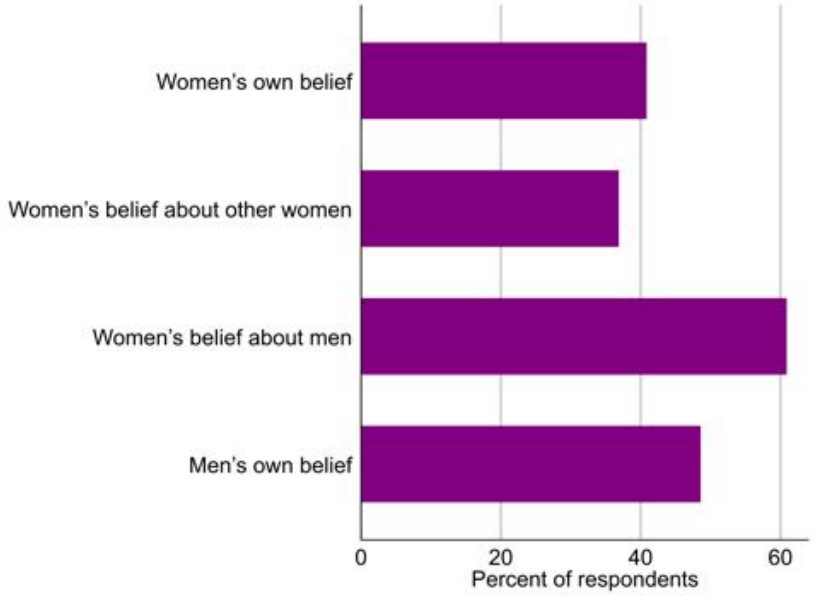


Figure A12: First and second order beliefs: percent of respondents who believe women who ride the public space are more open to advances than those who ride the women-reserved space



Note: Sampling weights applied.

Figure A13: Take-up of reserved space by opportunity cost level - lower bounds for attrition

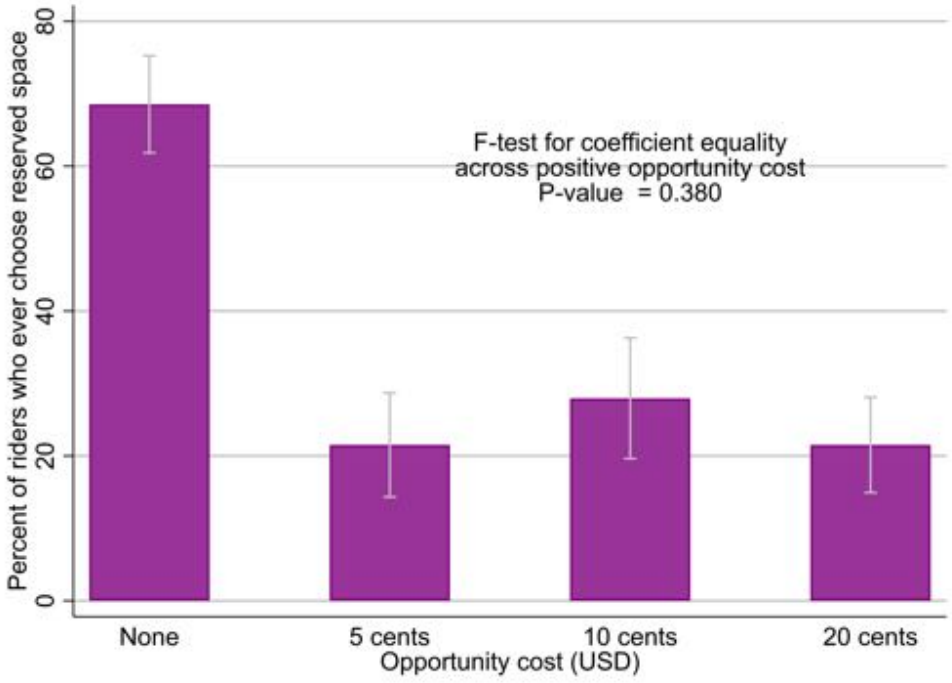


Figure A14: Sorting of men between spaces

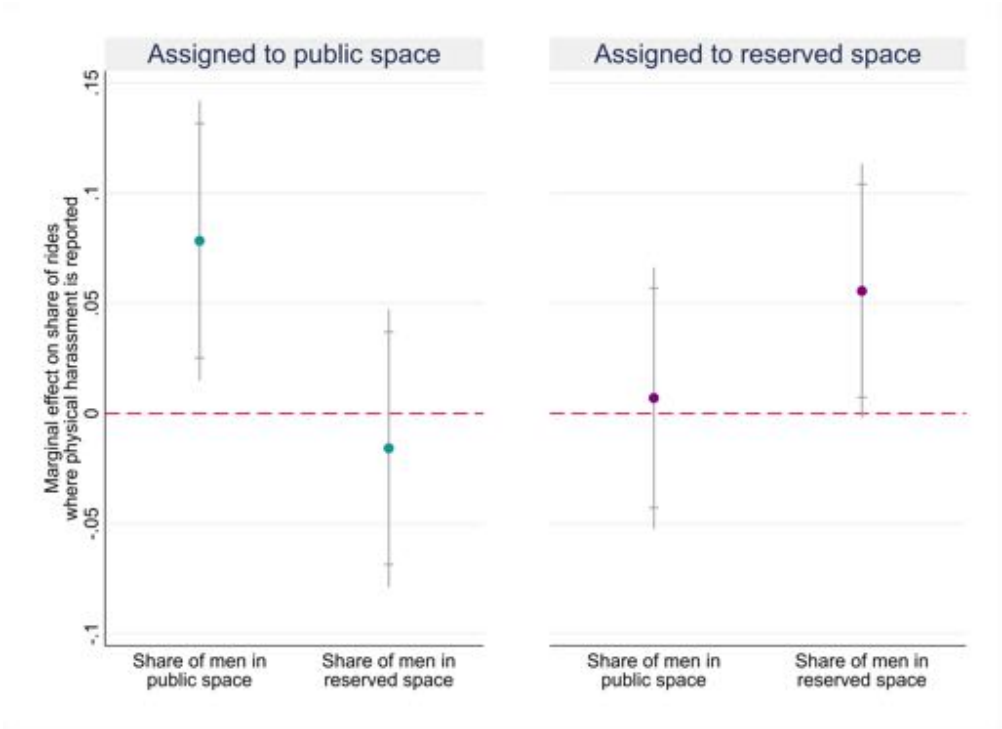


Table A1: Sample size description

	Number of riders	% of riders	Total number of rides	Average number of rides per rider
Panel A: Rider reports				
Demographic survey answered	263	72.5		
Rides phase started				
1. Revealed preference	363	100.0	17,766	49
2. Random assignment to reserved space	261	71.9	3,898	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

Notes: 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: Payments for riding public and reserved space per rides phase

Rides phase	Payment for public space task (USD)	Payment for reserved space task (USD)
1. Revealed preference		
Zero opportunity cost rides	4.50	4.50
Opportunity cost rides 1-5	4.70	4.50
Opportunity cost rides 6-10	4.55	4.50
Opportunity cost rides 11-15	4.60	4.50
Opportunity cost rides 16-20	4.55	4.50
3. Random assignment to space	4.70	4.70

Table A3: Demand elasicity

	Dependent variable: Chose reserved space	
	(1)	(2)
Opportunity cost: 5 cents	-18.364***	-51.896***
	(1.340)	(4.921)
Opportunity cost: 10 cents	-17.815***	-46.061***
	(1.286)	(5.562)
Opportunity cost: 20 cents	-16.654***	-51.654***
	(1.438)	(5.507)
Constant	26.659***	77.776***
	(0.698)	(3.286)
(Omitted category: Zero opportunity cost)		
Observations	15614	880
Level of observation	Ride	Rider
F-test for coefficient equality across positive OC		
Test statistic	1.455	0.738
P-value	0.235	0.479
F-test for demand elasticity equality across positive OC		
Test statistic	93.476	46.517
P-value	0.000	0.000

Notes: Sample include 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. Column (1) includes rider fixed effects. The F-test for demand elasticity tests that $\frac{\beta_{5cents}}{5} = \frac{\beta_{10cents}}{10} = \frac{\beta_{20cents}}{20}$. *** p < .01; ** p < .05; * p < .1.

Table A4: Correlation between platform observations data and rider reports

Platform observations	Dependent variable: Rider reports	
	Share of men in reserved space	High crowding
	(1)	(2)
Average share of men in reserved space	0.629***	
	(0.056)	
High crowding		0.239***
		(0.029)
Constant	0.161***	0.490***
	(0.018)	(0.018)
Observations	4797	20579
Riders	325	363

Notes: 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. *** $p < .01$; ** $p < .05$; * $p < .1$.

Table A5: 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 use reserved space				-0.013
				(0.067)
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

Notes: 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. *** p < .01; ** p < .05; * p < .1.

Table A6: Test for order effects in on screen presentation of public / reserved space

	Dependent variable: Chose reserved space	
	(1)	(2)
Reserved space shown first	0.004	-0.004
	(0.010)	(0.017)
Positive opportunity cost		0.019
		(0.019)
Reserved space shown first × Positive opportunity cost		0.008
		(0.020)
Constant	0.069***	0.050***
	(0.011)	(0.015)
Observations	6081	6081
Riders	273	273

Notes: 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. *** p < .01; ** p < .05; * p < .1.

Table A7: Adjustment on other margins

	Dependent variable:					
	Wait min	Against traffic	Switched spaces	Moved within the same space	Time - AM	Time - PM
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Revealed preference rides						
Positive opportunity cost	-0.160	0.002	-0.008	-0.002	-0.037	-0.049*
	(0.252)	(0.009)	(0.008)	(0.011)	(0.028)	(0.026)
Observations	17232	17596	10881	17766	9411	8355
Riders	363	363	361	363	354	356
Uncontrolled mean when zero opportunity cost	7.703	0.243	0.055	0.502	7.396	18.081
	(0.287)	(0.016)	(0.011)	(0.019)	(0.046)	(0.038)
Panel B: Randomized assignment of space						
Assigned public space	0.054	0.002	0.015*	0.039**	-0.034	-0.013
	(0.361)	(0.012)	(0.008)	(0.016)	(0.025)	(0.034)
Observations	3796	3842	3793	3015	2054	1844
Riders	261	261	259	179	241	251
Uncontrolled mean when zero opportunity cost	7.160	0.259	0.049	0.497	7.356	17.991
	(0.398)	(0.023)	(0.009)	(0.032)	(0.053)	(0.05)

Notes: 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. *** p < .01; ** p < .05; * p < .1.

Table A8: Impact of randomized assignment of car on fear and subjective well-being, overall and by ride condition

	Dependent variable: Above median on self-reported scale								
	Afraid of harassment	Overall wellbeing	Happy	Sad	Tense	Relaxed	Frustrated	Satisfied	Vs before
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Overall impact of randomized assignment									
Assigned to reserved space	-0.019	0.046**	0.044**	-0.048**	0.003	0.012	-0.036*	0.022	-0.006
	(0.017)	(0.023)	(0.020)	(0.022)	(0.023)	(0.025)	(0.020)	(0.019)	(0.015)
High crowding	-0.008	0.028	0.012	-0.081*	-0.054	0.008	-0.059	0.008	0.021
	(0.038)	(0.033)	(0.038)	(0.043)	(0.044)	(0.046)	(0.048)	(0.033)	(0.023)
Few men in reserved space	-0.020	-0.021	-0.017	-0.016	0.030	-0.029	0.002	0.003	0.029
	(0.019)	(0.027)	(0.029)	(0.021)	(0.028)	(0.026)	(0.019)	(0.026)	(0.018)
Uncontrolled mean when assigned to public space	0.210	0.295	0.330	0.466	0.419	0.474	0.483	0.415	0.138
	(0.013)	(0.014)	(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.015)	(0.01)
Uncontrolled mean in omitted category	0.237	0.310	0.303	0.519	0.454	0.499	0.513	0.388	0.153
	(0.02)	(0.021)	(0.021)	(0.024)	(0.023)	(0.024)	(0.024)	(0.023)	(0.016)
Panel B: Heterogeneous effects by male presence reserved space									
Many men in reserved space × assigned to public space	0.170***	0.311***	0.363***	0.213***	0.065***	0.387***	0.170***	0.514***	0.487***
	(0.015)	(0.021)	(0.021)	(0.022)	(0.023)	(0.023)	(0.021)	(0.019)	(0.016)
Many men in reserved space × assigned to reserved space	0.179***	0.325***	0.400***	0.157***	0.093***	0.413***	0.131***	0.556***	0.489***
	(0.013)	(0.015)	(0.016)	(0.012)	(0.018)	(0.017)	(0.013)	(0.016)	(0.009)
Few men in reserved space × assigned to public space	0.173***	0.263***	0.340***	0.191***	0.116***	0.370***	0.170***	0.534***	0.522***
	(0.020)	(0.027)	(0.024)	(0.023)	(0.025)	(0.026)	(0.022)	(0.022)	(0.016)
Few men in reserved space × assigned to reserved space	0.133***	0.333***	0.389***	0.149***	0.100***	0.371***	0.137***	0.540***	0.511***
	(0.012)	(0.018)	(0.019)	(0.013)	(0.021)	(0.020)	(0.015)	(0.019)	(0.012)
High crowding	-0.010	0.029	0.012	-0.080*	-0.056	0.007	-0.059	0.007	0.021
	(0.038)	(0.033)	(0.038)	(0.043)	(0.044)	(0.046)	(0.048)	(0.034)	(0.023)
Observations	3690	3591	3591	3591	3591	3591	3591	3591	3591
Riders	259	258	258	258	258	258	258	258	258
Rider fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-estimate tests for heterogeneous effects									
By assigned space: assigned reserved space - assigned public space									
$\Delta\hat{\beta}$ when few men in reserved space	-0.040	0.070	0.049	-0.041	-0.016	0.001	-0.033	0.006	-0.011
P-value	0.036	0.037	0.096	0.119	0.600	0.980	0.255	0.828	0.564
$\Delta\hat{\beta}$ when many men in reserved space	0.008	0.014	0.037	-0.057	0.028	0.026	-0.039	0.043	0.002
P-value	0.698	0.546	0.113	0.032	0.338	0.371	0.170	0.067	0.915
By male presence in reserved space: few men - many men in reserved space									
$\Delta\hat{\beta}$ when assigned reserved space	-0.046	0.008	-0.011	-0.007	0.007	-0.042	0.005	-0.016	0.022
P-value	0.049	0.801	0.752	0.756	0.856	0.229	0.842	0.626	0.286
$\Delta\hat{\beta}$ when assigned public space	0.002	-0.048	-0.023	-0.023	0.051	-0.017	-0.000	0.020	0.035
P-value	0.910	0.163	0.505	0.422	0.090	0.585	0.989	0.478	0.125

Notes: Unit of observation is the ride. 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. None of the estimates are precisely estimated using Q-values calculated as in Benjamini & Hochberg (1995) with code developed by Anderson (2008). * $p < .1$, ** $p < .05$, *** $p < .01$.

Table A9: Social norms survey

	Female respondent Mean/SE (1)	Male respondent Mean/SE (2)	Difference (1)-(2) (3)
Women in mixed car are more likely to accept advances	0.408	0.486	-0.077
	(0.041)	(0.042)	
Women invite advances then change mind	0.314	0.347	-0.033
	(0.037)	(0.041)	
Women on reserved space are less likely to invite advances then change mind	0.294	0.362	-0.068
	(0.037)	(0.040)	
Physical harassment is frequent on public space	0.472	0.472	-0.000
	(0.038)	(0.039)	
Ever chose not to go somewhere due to lack of safety or harassment on Supervia[1]	0.440	0.510	-0.070
	(0.037)	(0.039)	
Bystanders rarely intervene when witnessing harassment on public space	0.671	0.458	0.214***
	(0.035)	(0.039)	
Bystanders rarely intervene when witnessing harassment on reserved space	0.641	0.506	0.135**
	(0.036)	(0.039)	
Women are partly at fault if harassed on public space	0.217	0.199	0.018
	(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 female respondents for each question varies between 250 and 303. The number of males respondents 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 female relatives.

Table A10: Illustration of IAT structure: gender-career IAT

Round	Purpose	Respond left	Respond right
1	Training	Women	Men
2	Training	Home	Career
3	Stereotypical paired	Women and home	Men and career
4	Training	Men	Women
5	Non-stereotypical paired	Men and home	Women and career

Table A11: 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. *** p < .01; ** p < .05; * p < .1.

Table A12: IAT: Robustness check for differences in difficulty between stimuli

	Dependent variable:			
	Time (s)		Error rate	
	(1)	(2)	(3)	(4)
Provokes advances instrument	-0.113	-0.128	-0.073***	-0.081***
	(0.085)	(0.119)	(0.011)	(0.016)
Male respondent		0.216*		-0.005
		(0.113)		(0.020)
Provokes advances instrument × Male respondent		0.031		0.017
		(0.169)		(0.021)
Constant	2.171***	2.062***	0.204***	0.207***
	(0.057)	(0.075)	(0.010)	(0.014)
(Omitted category: Safety instrument, female respondent)				
Observations	11760	11760	11760	11760
Respondents	294	294	294	294

Notes: Unit of observation is one stimulus. Sample includes IAT test rounds for all participants who completed the test for both the safety and the provokes advances instruments. Standard errors in parentheses, clustered at participant level. *** p < .01; ** p < .05; * p < .1.

Table A13: 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)	-0.019	0.073*	-0.008	0.066	0.030
	(0.056)	(0.043)	(0.060)	(0.061)	(0.043)
Young (18 to 25 years-old)	-0.065	-0.016	-0.172***	-0.162**	-0.053
	(0.057)	(0.045)	(0.061)	(0.064)	(0.045)
Single	0.059	0.001	-0.002	-0.059	-0.023
	(0.052)	(0.042)	(0.056)	(0.059)	(0.040)
Employed	-0.071	-0.032	-0.143**	-0.128**	-0.056
	(0.054)	(0.042)	(0.058)	(0.060)	(0.042)
High self-reported socio-economic status	0.048	0.041	0.031	0.028	0.024
	(0.078)	(0.061)	(0.084)	(0.085)	(0.061)
Take-up at zero opportunity cost		0.000		0.001	-0.001
		(0.000)		(0.001)	(0.000)
Any take-up with positive opportunity cost					0.057
					(0.038)
Constant	0.751***	0.831***	0.718***	0.752***	0.983***
	(0.069)	(0.066)	(0.074)	(0.093)	(0.073)
Observations	372	297	372	297	226
Regression sample mean		0.843		0.614	0.884

Notes: 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 opportunity cost rides. Sample in column (5) includes only riders who completed at least 5 positive opportunity cost rides. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table A14: Effect of random assignment on participation

	Dependent variable: Took at least one ride
Offered reserved space	0.005
	(0.008)
Constant	0.112***
	(0.006)
Observations	9275
Riders	159

Notes: Unit of observation is person-day. Standard errors in parentheses, clustered at participant level. *** p < .01; ** p < .05; * p < .1.

Table A15: New IAT instruments developed by authors

Round	Purpose	Respond left	Respond right
		Panel A: Seeks safety IAT	
1	Training	Reserved space	Public space
2	Training	Seeks safety	Not worried about safety
3	Stereotypical paired	Reserved space and seeks safety	Public space and not worried about safety
4	Training	Public space	Reserved space
5	Non-stereotypical paired	Public space and seeks safety	Reserved space and not worried about safety
		Panel B: Provokes advances IAT	
1	Training	reserved space	Public space
2	Training	Sexually conservative	Provokes advances
3	Stereotypical paired	Reserved space and sexually conservative	Public space and provokes advances
4	Training	Public space	Reserve space
5	Non-stereotypical paired	Public space and sexually conservative	Reserved space and provokes advances

B 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 and its environment.

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 zero opportunity cost rides had experience riding the public space. In fact, all the participants who continued past the zero 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.

Fourth, in the randomized assignment portion of the experiment, participants were asked about whether they experienced any harassment. In case a respondent reported any harassment, the app directed her to the officials to whom she could report harassment incidences on Supervia 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.

C Robustness to attrition

For ethical as well as logistical reasons, participation in each ride opportunity was voluntary and compensated separately. This allowed participants to drop out of our experiment at any point. (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 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 opportunity cost, 84% continue to the opportunity cost rides and 61% to the randomized assignment of space.

We rule out two types of attrition that would introduce selection bias: selective attrition in response to treatment assignment and attrition on outcome levels. Tables A13 - A14 confirm that participants did not selectively drop out in response to treatment assignment on any given day. Our main results include participant fixed effects (Tables 2, 3). Assuming that attrition was at random, our estimates would still be unbiased. We show that our results are robust to estimation on the subsample of individuals who completed the entire sequence of activities including the exit survey, which confirms that attrition did not happen on outcome level. However, we cannot rule out attrition on growth in outcome.

Finally, 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 publice 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 A13 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. This bounding is not robust to non-monotonic selection on growth in outcome.