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

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Abstract

Sexual harassment is pervasive, yet its economic costs are largely undocumented. To capture these costs, we randomize the price women commuters in Rio de Janeiro face to ride in the women-reserved "safe space". 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 third of riders are willing to forego a subsidy equivalent to 10% of the fare to ride in the "safe space". Randomly assigning riders to the "safe space" reduces their experiences of physical harassment by 40%, implying a low-bound cost of avoiding physical harassment of 2.2 USD per incident. However, Implicit Association Tests reveal that commuters associate women riding in the public space with more openness to sexual advances. While the reserved space is safer in relative terms, 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 fact that women's freedom of movement may be constrained 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). The risk of violence might altogether discourage women from market participation (Velásquez, 2019) or from choosing better schools to avoid certain commuting routes (Borker, 2018). While these results mostly point to the effects of crime on the extensive margin of women's market participation, women who commute face these costs daily. Less attention has been devoted to measuring these potentially large and recurring costs.

The evidence on how to address sexual harassment in public spaces is scarce.[1] A common policy response to the recent increased public awareness of the prevalence of harassment in public transit is the creation of women-reserved "safe spaces".[2] Recent empirical evidence suggests that these reserved spaces may provide an avenue for avoiding harassment (Aguilar et al., 2018). Perpetrators may feel more entitled to harass women in the public space; 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 also 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 contribute to this debate by providing estimates of women's demand for a women-reserved space on the public transit system in Rio de Janeiro, Brazil. We elicit women commuters' revealed preferences for a reserved space and randomly assign them across reserved and public spaces. We

[1] A strand of the literature considers the role of various interventions in reducing the incidence of crime against women in the public space (Banerjee et al., 2012; Bisschop et al., 2017; Iyer et al., 2012; Cunningham & Shah, 2018), these studies do not isolate an effect on sexual harassment from other types of crimes.

[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.

recruit 357 women commuters to provide information on their daily rides through a smartphone-based application. Each rider is assigned multiple tasks, generating data on about 22,000 rides. We generate within-commuter variation in opportunity costs and location to provide a low-bound estimate of the cost of sexual harassment in public transit.

Eliciting revealed preferences establishes that riders place a positive value on accessing a women-reserved space. A third of riders are willing to forego the equivalent of 10% 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 40% 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 2.2 USD 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 1.3 % 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 in the public space, either through displacement or signaling. While this is a concern to establish the causal effect of creating a safe space, the incidence of harassment in the public space is the counterfactual of interest for women who are deciding whether to ride in the reserved space in a world where reservation has been introduced. Similarly, our estimates may be driven by changes in riding conditions other than harassment. To investigate this channel, 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. We use these data to rule out systematic differences

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

in crowding or fear of other types of crime such as property crime as alternative mechanisms. Hence, our estimates provide an unbiased measure of the incidence gap across spaces, yielding an unbiased measure of the implied cost of harassment.

A general equilibrium effect to consider is that creating a reserved space may have introduced 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. Our study builds on this literature by documenting a stigma on women who use the public space when they have the choice of a reserved "safe space".

We interview men and women commuters on the platform and administer 948 social normal surveys and 291 Implicit Association Tests (IATs) to capture the stigma women commuters may now face for riding in the public 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 discusses experimental evidence on avoiding harassment as a demand shifter, as well as evidence of a stigma against women riding in the public space. Section 7 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).

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

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] We exploit the availability of this reserved space to measure women's revealed preferences for a gender-segregated space, estimate incidence of harassment across gender-mixed and women-reserved spaces, and explore the social norm implications.

Our study is set on Rio's suburban train 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 **??** 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 of men with the reservation rule, one forth to one third of women could ride in reserved space. Male compliance with the reservation rule is enforced by platform officers who are responsible for the overall safety of the boarding process. In case of the Supervia, they do not have policing power. The presence of these officers varies substantially by station, and is particularly low in stations in the outskirts of the metropolitan area. Hence, the enforcement of the policy varies substantially.

3 Data

We generate two main sources of data to elicit demand for reserved space and document potential shifters of demand. First, we use a crowdsourcing app to collect panel data on female riders'

[4] Lei N° 4.733, de 23 de Março de 2006.

[5] According to Supervia administrative data

experiences and choices during their commutes. Second, we develop a platform survey and Implicit Association Tests to collect data on social norms and commuters' attitudes towards female riders in the reserved and public space from a representative sample of male and female commuters.

3.1 Crowd-sourced rider experiences

A sample of riders were recruited to report on their commuting experiences through a smartphone crowdsourcing 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 **??**). Figure **??** 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 to ride 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 **??**(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. 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 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 different spaces. Individuals are assigned an individual pipeline of specific 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. *Random assignment to space*: We measure the difference in harassment and well-being between the two spaces by randomly assigning whether the rider should use public or reserved space on that specific ride. Pay-out is equal regardless of assigned space.

In the first phase riders are presented with the option to ride in either the reserved or the public space. Upon completion of the check-in task, riders selfselect into either the reserved or the public space task; the pay-out is listed for each space. Total pay-out to complete a ride in the reserved space is $4.50 USD per ride.[6] Then, an opportunity cost for the reserved space is introduced

[6]This payment covers the Supervia transit fare.

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 **??**). Riders take an average of 50 rides in this phase. In the second phase, riders are offered to complete the task in a specific space and riders are assigned a random sequence of spaces across ten rides. The pay-out in this phase is $4.70 USD regardless of assigned space. Riders take an average of 15 rides in this phase. The screenshots in Figure **??** show how the ride task is presented during each study phase. Riders are not aware of their pipeline; no information is provided on the number of rides offered under each condition or the next task. The study phases are described in more detail in sections 5 - 6. The exact information to collect varies slightly by study phase. Only in the second phase of the study do women report on different types of harassment. This is further described in section 6.

Several quality control measures are taken. 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, regardless of the total number of rides they complete, 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 **??**, panel A, shows the number of riders that progress through each of the study stages. Appendix C discusses robustness 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 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 **??**).

3.2 Platform Survey and Implicit Association Test

To measure other commuters' attitudes towards women in the public space, we conduct a complementary data collection among a random sample of both male and female commuters, recruited at the 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

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

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 **??**, 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 **??** 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 6.2. 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 **??**, 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 **??** column 2). Women's stated use of the reserved space is not significantly correlated with response to the IAT (Table **??**, 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 **??**, 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

[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.

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 **??** shows crowding reports from our platform 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 **??**). 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 **??**).

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 **??**). 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 **??** 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

[11] According to Supervia reports.

space to use (Figure **??**). Compliance with the policy varies by time of day and location. Figure **??** shows compliance is better at stations closer to the city center. Figure **??** 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 **??**, Panel A, shows socio-economic characteristics of the riders and platform survey respondent. Column 1 shows data for participants in the rider crowdsourcing. 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 overrepresented in the riders sample relative to the representative platform sample, likely because the unemployed might be using participation as a form of employment. 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 **??**). 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 measurements. 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 **??** and **??** illustrate this choice as it was presented to riders in the app. All riders start with at least 5 rides where the pay-out to either using either space is equal (Figure **??**); a rider's choice of reserved or public space does not affect her compensation and riders are paid $4.50 USD regardless. Then we introduce variation in opportunity costs for riding the reserved space instead of the reserved space through a higher payment to ride in the public space. This was flagged in the app to put salience on the price difference (Figure **??**). Participants

[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.

proceeded through a fixed sequence of rides with varying price differentials, shown in Table **??** We randomize whether the reserved or public space option is offered on top in the app.[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 now 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, so the effect of the opportunity cost is identified from within-rider variation over rides; standard errors are clustered at the rider level. Results are reported in Figure **??** and **??**.

At zero opportunity cost, approximately 80% of participants use the reserved space for some of their rides (Figure **??**). Looking at the extensive margin of use, we find that riders use the reserved space for 25% of these zero-opportunity cost rides (Figure **??**). This suggests a preference for the reserved space beyond random sorting, as only 12.5-16.7% of the cars 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 still observe that about thirty percent of riders select the reserved space for some of their rides. This suggests a positive willingness to pay for the reserved space. Willingness to pay does not vary significantly across different opportunity costs, which 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]

[14] Table **??** shows that this order does not affect the results.

[15] In a subsequent phase, participants were assigned to a 60 cent opportunity cost. Unfortunately, a routing error

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]

Controlling for ride conditions does not change the results (Cols 1 and 2, Panel A, Table **??**), 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 or travel time (Panel A, Table **??**). Results from these specifications reveal small imprecise effects on all observed margins of adjustment.

How does compliance to the reservation rule 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 6.6 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 24% increase in demand ($p-value < 0.000$; Panel B, Table **??**). This demand response is reduced by two thirds in the presence of an opportunity cost to ride in the reserved space ($\Delta\hat{\beta} = 0.022, p-value = 0.041$).

in the app rendered these rides unusable.

[16] We impute platform observation variables to rides using the mean observation for each 30 minute time window-line segment combination as indicators for above / below sample median for the whole study period.

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 **??** describes the relationship between crowding and (1) demand for the reserved space, and (2) the share of men is the women-reserved space.[17] 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, to most riders, the value of 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 **??**). Interestingly, riders who are willing to forego 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

Avoiding harassment and safety is the reason over 80% of riders provide when asked about the main benefits of the women-reserved space (Figure **??**). We investigate this mechanism more formally in two ways. First, we break down the results from the revealed preference rides by self-reported perceived risk of harassment. Second, 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.

[17] In November-December 2016, we worked with the Supervia authorities to implement an experiment to deploy enforcement staff to increase enforcement of the reservation rule. However, due to limited numbers of staff, this was unsuccessful at decreasing the number of men observed on 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 fixed effect for the wave in all specifications.

[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.

We start by interacting 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 **??**. 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 **??**). However, this effect goes to zero when riding the reserved car requires foregoing 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 forego 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 **??**).

Experimental assignment to the women-reserved space

We design and run an experiment in which we assign our rider participants to either the women-reserved or the public space and ask them to report whether they were exposed to harassment during their ride. This experiment provides an estimate of the incidence of harassment; as such, it sheds light on avoiding harassment as a mechanism underlying the demand for the reserved space we documented in our first phase. 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 which space she was assigned to. Panel C of Figure **??** 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

[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 **??**).

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.

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 standard errors are clustered at the rider level.

Table **??** 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 in 17% of rides. When assigned to the reserved space, riders are 2.7 percentage points less likely to report experiencing any harassment, or 15.8%, (cols 1-2, Panel A, Table **??**). Columns 3-8 break this down by type of harassment. The effect is large and precisely estimated on the probability of experiencing physical harassment (41.9%), while the effect on verbal harassment and staring is smaller (12.9 and 8.9%, respectively) and imprecisely estimated.

Previous results showed 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 predicts the value of the reserved space. We estimate (3), interacting $AssignedToReservedSpace$ 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. Results are reported in Panel B of Table **??**. The bottom panel reports statistical tests of coefficient equality across the random assignment to a space and the level of compliance to the reservation rule. The protective impact of the reserved space are largest when the reservation rule is more closely followed: being assigned to the reserved space reduces the

incidence of physical harassment by 1.9 percentage point ($p - value = 0.003$) relative to being assigned to the public space (cols 3-4, Panel B, Table **??**). This effect is halved and imprecisely estimated when the reservation rule is not well followed.

20

Taken together, these results suggest that the reserved space offers partial relief from sexual harassment. While these results show 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.

mention appendix table here with back of envelope calculations

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 **??**). 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 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 investigate this formally by testing whether a high perceived risk of property crime (robbery) mediates women's preference for the reserved space. Table **??**, columns 7-9 show that women who perceive the risk of robbery on their daily commute to be high are no more likely to choose the reserved space; if anything, the point estimates suggest

[20] Table **??** shows that the reduced harassment also translates into improved subjective wellbeing on some measures: moving to the women-reserved space reduces participants' fear of harassment during the ride, and increases their self-reported wellbeing: they are more likely to report feeling happy and less likely to report feeling sad and frustrated.

the opposite, but are imprecisely estimated.

6.2 Avoiding stigma

We now investigate the possibility that introducing a women-reserved space may have led to the emergence of a 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 equilibirum. To explore the attitudes women faced on their daily commute, we design a social norms survey and a pair of IATs which we administer on a representative survey of male and female commuters on the platform.

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 **??**). Figure **??** 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 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 a "gut reaction," not 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 **??**). 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. Online Appendix D details the design of the IAT instrument including the full list of stimuli.

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:

$$Score_{ij} = \beta_0 + \beta_1 AdvancesIAT_j + \beta_2 FemaleRespondent_i + \beta_3 AdvancesIAT_j FemaleRespondent_i + \epsilon_{ij} \quad (4)$$

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 **??** shows the distribution of the IAT scores by instrument and gender, and Table **??** 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 **??** 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 (**??**).

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 **??** shows the results.

7 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.

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Figures

A Supplementary figures and tables

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. As a result overall attrition of those who opened and tried out the app is high. (Table **??**) shows descriptive statistics on participation patterns throughout the sequence of rides. Of the 546 initial participants who tried out at least one ride with zero opportunity cost, 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 was 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.

All variation in both the revealed preferences rides and randomized assignment experiment is within-respondent. Tables **??** - **??** confirm that participants did not drop out or respond selectively in response to treatment assignment on any given day. Our main results include participant fixed effects (Tables **??**, **??**). They are also robust to estimation on the subsample of individuals who completed the entire sequence of activities including the exit survey. Thus attrition does not present a threat to internal validity.

Attrition could also affect external validity: for example, if women who have a strong preference for the reserved space are more interested in the experiment and choose to continue, we might estimate a value for the reserved space that is correct for this sample but large compared to the general population. To investigate this, we examine the correlates of attrition in Table **??**. Younger women are less likely to continue past the revealed preference rides to the randomized space assignment phase, but other demographics do not predict attrition. We find a small negative relationship between take-up of the reserved space when there is no difference in pay-out for riding in the different spaces and continuing to the rides with positive opportunity cost for riding the reserved space: women who prefer the reserved space are *less* likely to drop out, which would bias our estimates of willingness-to-pay downward. Continuing to the randomized assignment phase is also not correlated with participants' revealed willingness to pay.

To further investigate this issue, we also 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 **??** 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. Finally, we compare the stated willingness to pay of our rider sample to that of the representative sample of commuters surveyed on the platform.

D IAT design

Table A1: 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