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RIDE WITH ME

ETHNIC DISCRIMINATION IN SOCIAL MARKETS*

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Abstract

We study ethnic discrimination in Europe's largest carpooling marketplace. Using a unique dataset with more than 17,000 rides, we estimate the effects of drivers' perceived name origins on the demand for rides. Carpooling is a novel application for studying ethnic discrimination where consumer choice entails social interaction with the service provider (i.e. driver). We find large discrimination effects for drivers with Arab, Turkish or Persian sounding names. Further analyses support assumptions consistent with statistical discrimination. Our findings broaden the perspective of ethnic discrimination by shedding light on subtle, everyday forms of discrimination in social markets and fuel ongoing discussions about anti-discrimination efforts in an era in which markets increasingly move online.

Keywords: Ethnic discrimination; statistical discrimination; taste-based discrimination; online markets; computational social science

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1. Introduction

Decades of social science research provide evidence of ethnic and racial discrimination in various areas of society and in numerous countries (e.g. Pager 2007; Pager & Shepherd 2008; Rich 2014). Most prominent areas of discrimination research include access to labor and housing markets. Despite decades of policy responses and the introduction of anti-discrimination legislation designed to attenuate ethnic and racial disparities, discrimination appears to persist (Pager et al. 2009). Discrimination studies continue to enjoy attention as discrimination is seen as one of the key mechanisms for explaining enduring economic and social inequality in society. Online markets offer a new perspective on the diverse settings in which ethnic discrimination can occur and provide new channels to test assumptions about why and how members of ethnic or racial minorities are being discriminated against (e.g. Zussman 2013; Edelman et al. 2017).

We join this effort by examining the extent and the drivers of ethnic discrimination in Europe's largest online carpooling market. We compile a new dataset of more than 17,000 carpooling rides offered in Germany by programmatically collecting ride information from an online platform. We estimate the effect of drivers' perceived name origin on the demand for their offered rides (clicks on offer). In order to group names into perceived ethnic backgrounds, we conducted a separate online survey with 1,577 participants who rated a total of 1,381 unique first names to distinguish the associated origin of drivers. Participants distinguished between typically German names and names with an Arab, Turkish or Persian origin. The former group is the largest and most recognizable immigrant community in Germany.[1] Previous studies found that this particular group is disproportionately affected by discrimination (e.g. Blommaert et al. 2014; Diel et al. 2013).

In carpooling markets, private individuals use online platforms to offer seats in their car for a particular ride. Carpooling websites have become serious competitors for conventional bus

and train providers across Europe, in particular in low-budget segments of the transportation market.[2] Carpooling in Europe offers mid- to long distance rides from city to city rather than short taxi rides within cities (like services such as Uber).

Carpooling platforms are a unique application for ethnic discrimination studies that offer several advantages for advancing knowledge on the issue of ethnic discrimination. First, carpooling is not only an economic market where riders select drivers with the best economic value (e.g. price per distance). Carpooling is also a social market. The decision to acquire the service is linked to spending time with the service provider (i.e. the driver). As such, the decision to share a ride entails social, face-to-face interaction. This distinguishes carpooling from other online markets for consumer goods (e.g. Doleac & Stein 2013; Ayres et al. 2015, Ewens et al. 2014). Carpooling may thus help to draw attention to ethnic discrimination in social situations and reveal subtle, everyday forms of discrimination that may otherwise go unnoticed.

Second, online markets such as carpooling are ideally suited to isolate ethnic effects. We are able to observe all characteristics that are visible to the customer including the driver rating, experience, the car et cetera. This setup allows us to ameliorate issues related to both experimental designs – because we do not introduce an artificial treatment that would otherwise not occur in this way[3] – and observational studies which may suffer from omitted variable bias.[4] For example, audit studies have often been criticized for introducing additional unobserved factors such as demeanor and socioeconomic background that may 'pollute' the treatment. This information is not available for selecting a carpooling ride.

Third, we exploit variation in the information about drivers (i.e. user ratings, experience, socializing preferences, profile picture) to test assumptions about the mechanisms driving ethnic discrimination, particularly statistical versus taste-based discrimination. While we provide a novel application of ethnic discrimination, we also exploit this particular setting of carpooling to test mechanism that may drive discriminatory behavior.

Our results indicate large ethnic discrimination effects. Controlling for all observable information, drivers with an Arab/Turkish/Persian sounding name attract less interest in their offers (fewer clicks on the offer) than drivers with typically German names. Group differences cannot be explained by any other observable characteristic associated with the driver or the offered ride. To achieve the same demand compared to a German driver, the average driver with an Arab/Turkish/Persian sounding name would have to offer their ride at 23% less than the price for an average ride.

Further tests largely support assumptions of statistical discrimination theories. Consumers appear to use the name as a proxy signal to infer the 'true' value of the ride in economic, safety and social terms. When rich information about the driver is available (i.e. high rating, profile picture), ethnic discrimination disappears as consumers rely less on the name.

Our findings have important implications for policy. First, ethnic discrimination occurs in social online market platforms. This expands the view from traditional discrimination studies in the labor market and housing to more subtle, everyday forms of unequal treatment. The results draw attention to other sectors with stronger social interaction elements, including the service and care sector, hiring in small teams, and group environments such as membership in clubs, associations and interest groups. Second, insights into the mechanisms of discrimination can be the starting point for policy design aimed at reducing disparities (e.g. Guryan & Charles 2013; Nunley et al. 2011). Our results suggest that providing more relevant information about actors in markets may be an effective strategy to reduce discrimination effects. Third, our results fuel the discussion around the need for anti-discrimination efforts in markets that increasingly operate online. While consumers and service providers are often protected against discrimination in real-world markets (for instance hiring, housing, hospitality and consumer goods), similar provisions often do not exist in online markets (see Edelman et al. 2017).

2. Evidence and Mechanisms of Ethnic Discrimination

Ethnic and racial discrimination can be defined as differential treatment (that leads to unequal outcomes) based entirely on ascribed features that are associated with non-majority status such as race, ethnic background, name origin, foreign appearance etc. (Blank et al. 2004).

Recent reviews document strong discrimination effects in employment, housing, credit and commodity markets (Pager & Shepherd 2008; Rich 2014). The strongest evidence for ethnic discrimination is based on studies employing experimental designs (Rich 2014). Studies show that racial or ethnic minorities are – ceteris paribus – disadvantaged in terms of access to labor market (interview invitations, call back rates, wage offers, treatment in interviews) and the housing market (renting, buying or selling apartments and houses) compared to individuals from the majority population.

More recent studies have made advances in two ways: First, they have broadened the application of discrimination studies to other markets (Bryson & Chevalier 2015; Doleac & Stein 2013; Edelman et al. 2017; Gneezy et al. 2012; Nunley et al. 2011; Zussman 2013). Second, researchers have fine-tuned experiments to test hypotheses about why discrimination occurs opposed to whether it occurs (Gneezy et al., 2012; Guryan & Charles, 2013).

In terms of relevant mechanisms, much of the literature across the various domains attempts to discern whether discrimination stems primarily from taste-based discrimination (racial animus/ prejudice) or from statistical discrimination.

In the case of taste-based discrimination (Becker 1971), the driver of discrimination is a negative disposition towards certain groups. In our case, an individual may suffer ‘disutility’ resulting from contact with an ethnic minority. As such, taste-based discrimination relies on the presence of prejudice. Prejudice in return can loosely be defined as an affective, mostly unfavorable feeling toward a person or group member based solely on their group membership.

In the case of statistical discrimination, differential treatment based on race and ethnic background arises from incomplete or asymmetric information about the productivity of actors (Arrow 1973; Phelps, 1972).[5] When limited information about a product or an individual is available, agents rely on observable group characteristics (such as ethnic group, race) to make inferences about the individual. Another class of statistical discrimination models focuses on the reliability of the information that employers have about individual productivity (Aigner & Cain 1977; Altonji & Blank 1999). At the core of both of these strands of statistical discrimination is the notion that a lack of information leads the employer to treat individuals as members of groups (Guryan & Charles 2013). In comparison, animus, or taste-based discrimination, is a negative reaction to ethnic background itself, independent of other characteristics.

Past evidence on the dominant form of ethnic discrimination remained inconclusive as support for either mechanism varies considerably across studies (Ewens et al. 2014). However, recent (experimental) studies point to the importance of statistical discrimination (rather than tastes) for explaining why discrimination persists (Altonji & Pierret 2001; Bryson & Chevalier 2015; Ewens et al. 2014; List 2004; Zussman 2013). Growing evidence in favor of statistical discrimination is good news given that information asymmetries may more easily be addressed than deep-seated prejudice. Our study aims to provide additional analyses to discern statistical discrimination from taste-based discrimination.

2.1. Ethnic Discrimination in Online Carpooling

Our study joins the effort of leveraging online markets – in our case, the largest European online carpooling market – for the study of ethnic discrimination. Carpooling markets match drivers that offer available seats in their car to riders that look for affordable one-off transport between cities. Riders can search rides by departure/ arrival town and date. We estimate the effect of an Arab/Persian/Turkish sounding name on the demand of offered rides as measured

by clicks. We interpret group differences in clicks net off all observable characteristics of the driver and the offered ride as evidence for ethnic discrimination.

In this brief section, we outline three different possible outcomes to our research question of whether and why ethnic discrimination exists in carpooling markets: 1) no discrimination effects 2) discrimination effects, likely driven by tastes 3) discrimination effects likely driven by statistical discrimination.

Regarding 1) we propose that is it plausible to expect no ethnic discrimination effect owing to the particular context of carpooling and our study design. First, carpooling consumers are on average younger than the general population (31 years in our sample, 44 years in Germany). Second, rides provide transport between urban centers which suggest that the customers are also more likely to live in urban areas. Third, sharing a ride with a stranger already requires a certain level of trust and low risk aversion. Fourth, online market platforms have been shown to reduce information asymmetries associated with productivity and correct biases against certain groups (Agrawal et al. 2013). Accordingly, it would not be surprising to find no significant discrimination effects given that we control for all observable information about the ride and the driver. In this light any effect that we may find is likely conservatively small compared to average ethnic discrimination in the German society.

Regarding 2), taste-based ethnic discrimination approaches suggest that consumers discriminate against drivers with a foreign name, because they simply wish to avoid contact with a member of an ethnic minority. In carpooling, this means that we would expect discrimination effects regardless of variation in other information about the driver. Compared to commodity markets, taste-based ethnic discrimination may be more likely detectable in carpooling as the customer is spending several hours with someone from an ethnic minority in a narrow space (a car). In this case, simply the fact that the driver is associated with an ethnic minority should lead to unequal treatment regardless of other observable characteristics of the ride or the driver.

Regarding 3), statistical discrimination approaches offer several ways in which drivers from an ethnic minority could be discriminated against. All are based on the assumption that consumers use the name of the driver as a signal to infer the true 'value' of the ride and that the value depends on the degree of provided information about a ride rather than exclusively on the name origin of the driver. One advantage of our large dataset is the fact that we can test for different stereotypes which are implied in the statistical discrimination model. We hypothesize that a negative ethnic effect on clicks could generally be driven by three different sets of considerations: 1) price and comfort relative to distance, 2) personal safety and 3) the social value.

Based on a narrow economic perspective, consumers simply click on the ride that offers the cheapest price relative to the distance travelled. Other factors may include the car quality as an indication how fast and comfortable the ride will be. In our setting, we control for the distance of the ride, the price and the car comfort.

Other consumers may choose an offer based on how secure they perceive the ride. Security has to be inferred from other available information as there is no objective indicator of security and safety on the platform. We assume that costumers use the name of the driver as two signals for perceived safety of a ride. First, it is a common stereotype that 'migrants', especially males, commit more crimes (e.g. Fitzgerald et al. 2011, Trager et al. 2014).[6] The other common safety-related stereotype could be that foreigners drive less safely because traffic regulations are less strict or less enforced in their origin countries. To the best of our knowledge there is virtually no reliable comparable data to prove or disprove this stereotype, but surveys suggest that the stereotype exists.[7]

Lastly, the value of a particular ride (and as a result, demand for that ride) may be driven by the desire for pleasant social interaction. We know from previous research that ethnic minorities are disadvantaged, for example, in flat sharing markets – a market where choices include social interaction (e.g. Przepiorka 2011). Consumers may click on those offers that

suggest the most enjoyable time during the ride. Sharing a ride means sharing private space as car-poolers sit in close proximity. Again, the name of the driver could be a proxy for language. Pleasant conversation is less likely if the driver speaks a different language and possibly listens to 'foreign' music. We estimate an interaction effect with music and dialog preferences to test this assumption. Studies on online dating have shown that clear ethnic/racial preferences exist that commonly disadvantage minorities (Jakobsson & Lindholm 2014, Lin & Lundquist 2013; Robnett & Feliciano 2011). Similar to those markets, consumers in carpooling markets may be driven by homophily preferences, i.e. looking to meet drivers who are most like them (see McPherson et al. 2001). Again, the name would signal greater social distance given that the large majority of consumers are Germans.

As there is no direct indicator for safety or sociability, consumers have to rely on other available information, including the name. We argue that the user rating, number of ratings and the driver experience are suitable aggregate proxies for both categories. A bad user rating or low experience suggests that the ride may be less safe and less pleasant. Similar to studies that attempt to test statistical discrimination, we will interact the ethnic indicator with other indicators about productivity signals, in this case, the user rating and experience (Blommaert et al. 2014; Ewens et al. 2014; Nunley et al. 2011). Accordingly, if discrimination varies depending on the information available about the driver, we assume that statistical discrimination applies. Similar to Nunley et al (2011), we argue that statistical discrimination would predict that consumers' prior beliefs regarding the trustworthiness of drivers with an ethnically distinct name diminishes as other pertinent information about credibility becomes available. The scarcer other information about the 'true' safety and 'fun' of the ride, the more consumers rely on stereotypes regarding the perceived name origin. In our design, the user rating is based on experience of the driver (how many rides he or she has offered in the past) and the customer satisfaction. The user rating is a strong signal about the trustworthiness of provided information online and the 'true' productivity of the ride. We use additional proxies

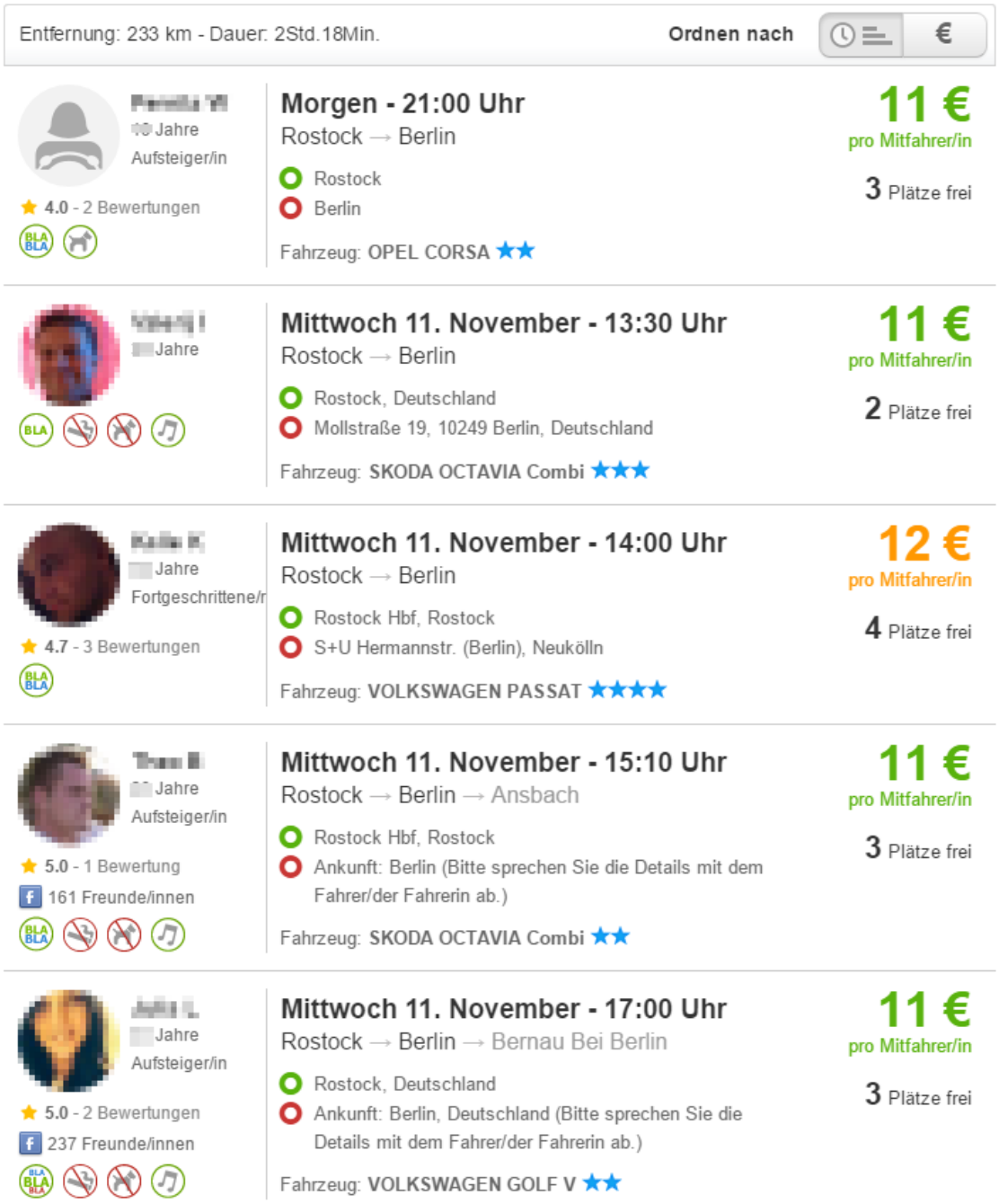
of safety and sociability to test statistical discrimination including the profile picture (homophily, trust), talking and music preferences (sociability) and gender (safety).[8]

3. Data & Methods

3.1 Data Collection

We compile a new dataset with the aim to achieve the best possible balance between internal and external validity of discrimination effects. Using Europe's largest online carpooling platform, we compile a dataset of 17,294 observations (i.e. rides) in Germany that were listed online between 16 July 2015 and 27 July 2015.[9] According to the provider, the platform offered 250,000 rides in 2013 and 2014. The platform has 30 million members in 22 countries. According to the company's website, 10 million users use the website every quarter. Based on access to an Application Programming Interface, in short API, we collected information on all observable information on the offered rides and the drivers. The visual interface (see Figure 1) shows information about age, gender, user picture if available, user rating, car, timing and stops of the ride, price, available seats and some preferences of the driver (smoking, music, talking).

Figure 1: User Interface of Online Carpooling Platform



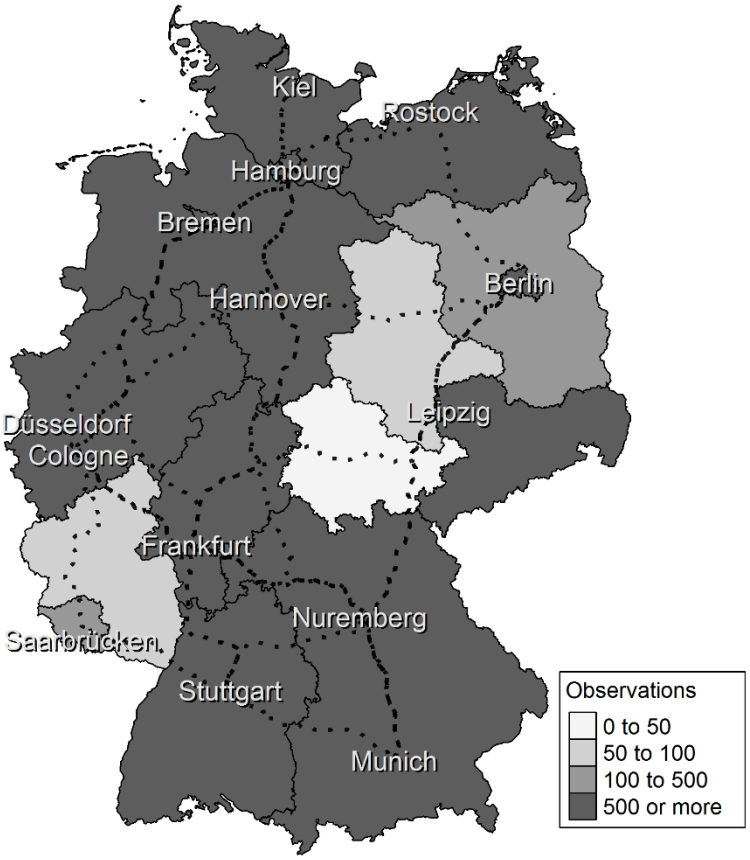
Source: Carpooling Data Germany 2015 (compiled by authors). Images, names and age of drivers pixelated. See main text for description in English.

Rides shown in Figure 1 are offered by drivers traveling from Rostock to Berlin. For instance, the first driver offered a seat for his ride at the price of 11 Euros. He has two positive user ratings from earlier interactions on the market. Furthermore, he prefers to talk during the trip

and does not mind customers to travel with their pets. In contrast to the other ride offers in Figure 1, the driver did not upload a picture.

Due to volume and restrictions from the provider, not all rides in the market could be collected. As a result, we selected routes between the largest cities in all 16 German states (Länder). Carpooling is more common between urban centers due to supply and demand for rides. Our strategy allowed us to approximate a balanced geographical representation of observed rides for different regions in Germany. As a second step, we selected additional large cities in regions with larger populations, particularly regions with higher shares of ethnic minority residents. Oversampling was necessary to ensure a sufficient sample of drivers with foreign-sounding names (see Figure 2).

Figure 2: Sampled rides in online carpooling market



Source: Carpooling Data Germany 2015 (compiled by authors)

The data was collected in two steps: First, we pulled data from the API and, second, we used the programming language Python to automatically access the website four times a day at equal intervals between 16 July 2015 and 27 July 2015 (more technical information available upon request).

3.2 Measurements

We assess group differences regarding demand for offered rides on the carpooling platform. Demand is measured by clicks. We regress the maximum number of clicks that a ride received until departure using a negative binomial regression (see Figure B1 in the Appendix for distribution of clicks). [10] In the analysis the number of clicks is adjusted for the number of days that the offer was displayed online.

We restrict our sample in several ways: First, we drop rides that depart after the end of our observation period (right-censoring). This is necessary to obtain an accurate measure of maximum clicks before departure. Second, we restrict the sample to rides that were uploaded no sooner than seven days before we started collection information. One week is an appropriate time window given that most rides are uploaded a few days before departure. Third, we drop cross-border rides as consumers are most likely not German and clicks are inflated as affected rides are also listed in carpooling platforms for neighboring countries where the provider also operates. Fourth, we limit our sample to routes (e.g. departure city: Munich – arrival city: Berlin) that have more than one offered ride per day and have at least one driver with an Arab/Turkish/Persian name[11]. This step is important to ensure that we can observe a counterfactual, i.e. consumers cannot discriminate against ethnic minority drivers if there are none. It is important to note that all our models additionally control for route and volume (number of offered rides per route and day). The final sample for the analysis of clicks includes 17,294 rides, including 528 rides with an Arab/Turkish/Persian driver.

As our main independent variable regarding discrimination, we use the first name of the driver to infer whether the name is 'typically Arab/Turkish/Persian' or 'typically German'. Names signal membership to particular ethnic group (regardless of whether the signal is true) and 'ignite' potential stereotypes (e.g. Bertrand & Mullainathan 2004, Booth et al. 2012).

Driven by concerns about objectiveness and reliability of name ratings, we conducted a large online survey in which respondents were asked to rate driver names that we extracted from our carpooling sample. In total, 1,577 student raters participated in the survey. The origin of 1,381 unique names were on average rated by 20 participants (SD=4.6).[12] As carpooling customers are younger than the national average (20 years younger than the national average for Germany), students represent an appropriate approximation of real customers. Table 1 shows the most frequent names by perceived name origin.

Table 1: Most frequent name origins with high origin certainty

#	Arab/ Persian/ Turkish	German
1	Ali	Thomas
2	Mohammed	Christian
3	Süleyman	Daniel
4	Seref	Martin
5	Mohamed	Michael
6	Kadir	Alexander
7	Serdar	Andreas
8	Ismail	Sebastian
9	Mustafa	Markus
10	Cem	Jens
11	Osman	Peter
12	Salman	Tobias
13	Yusuf	Christoph
14	Amir	Matthias
15	Ercan	Stefan
16	Mehdi	Chris
17	Oguz	Robert
18	Rami	Jan
19	Ahmad	Volker
20	Ersin	Friedrich

Note: Most frequent driver names by name origin based on online survey ratings (N=1,577 survey participants; 20 ratings per name on average).

For the analysis, we use an 80% cut-off for determining an Arab/Turkish/Persian name. That is, the driver is considered to have an Arab/Turkish/Persian name if four out of five survey participants considered the name to be typically "Arab, Turkish or Persian". We also report

results for the continuous measure of Arab/Turkish/Persian name origin variable in percentage points (see Figure 4 below). We grouped Arab/Turkish/Persian sounding names together because they are difficult to distinguish for the average resident in Germany and are commonly associated as being from the same world region. Members of this broad group are associated with the largest and most recognizable immigrant community in Germany (mostly descendants of low skilled guest workers that arrived since the 1960s). Previous studies have highlighted that members of the Arab/Turkish/Persian community appear disproportionately affected by discrimination (Blommaert et al., 2014; Diehl et al., 2013).

For the analysis of mechanisms, we exploit variation in information about each offered ride to test assumptions of the statistical discrimination and taste-based discrimination. The key variable here is the user rating. The rating score is an average of past riders' general evaluation of their ride with the respective driver who offered it. Past riders can rate the driver retrospectively. As a result, the rating is a strong signal of safety, sociability and overall trust. To test the sociability argument in particular, we estimate an interaction of the name with the profile picture and the music and dialog preference. Drivers that provide a profile picture as personal information increase their trustworthiness. The profile picture may also function as a proxy sociability perceptions. The 'talking preference' indicates whether or not the driver is interested in talking during the ride which we use as one additional measurement for the sociability argument. Finally, we estimate an interaction with name and sex. We assume that negative stereotypes regarding the safety of rides with 'foreign' drivers largely apply to male drivers.

Controls include all the information that is observable to consumers, including information about the offered ride (route, time, distance) and the driver such as age and gender (see Table A2 and Table A3 in the Appendix for a full description and distribution of all model variables). Regardless of ride and driver information, the clicks on offer may simply be driven by the size of the potential user population which varies considerably across the sampled

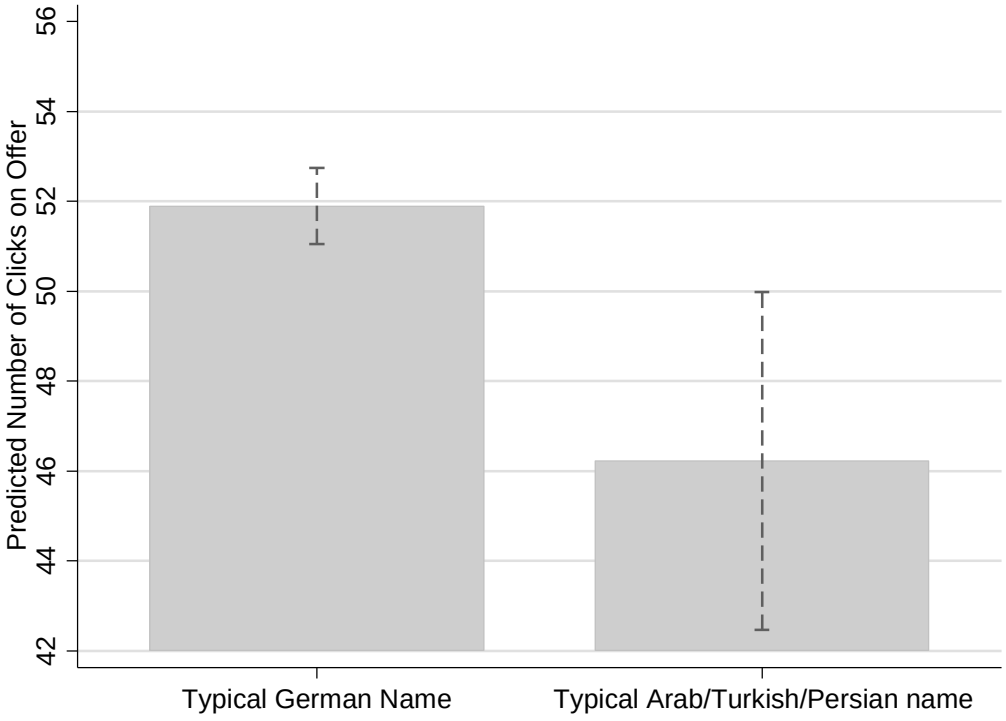
cities and regions in Germany. As a result, we control for the demand side using a route identifier (departure/ arrival city * departure date).

4. Results

The analysis confirms substantial discrimination effects in Germany's online carpooling market. Arab/Turkish/Persian drivers attract less demand (measured in clicks) than German drivers for the same ride. Controlling for all observable characteristics of the ride and the driver that are visible to consumers, we find that drivers with an Arab/Turkish/Persian sounding name obtain on average 5.4 clicks less than a driver with a typical German name (see Figure 3 and Table A3 the Appendix).

5.4 clicks represent approximately 10% of the average number of clicks per offered ride in the sample (51 clicks). In a separate step, we calculate the average discriminatory price penalty, i.e. the average willingness to pay to avoid riding with an Arab/Turkish/Persian driver. Dividing the name coefficient by the price coefficient indicates that Arab/Turkish/Persian drivers would have to offer their rides on average 3€ cheaper than German drivers to achieve the same number of clicks. This accounts for 23% of the average price of an average ride in our sample. The 23% price penalty is robust for setting covariates to different values, for example a male, twenty-year-old Arab/Turkish/Persian driver with little experience offering a 300 kilometer ride in a comfortable car on a Sunday afternoon. Figure 3 uses the 80% cut-off to determine drivers with an Arab/Turkish/Persian name.

Figure 3: Predicted Number of Clicks on Offer Ride by Name Origin of the Driver

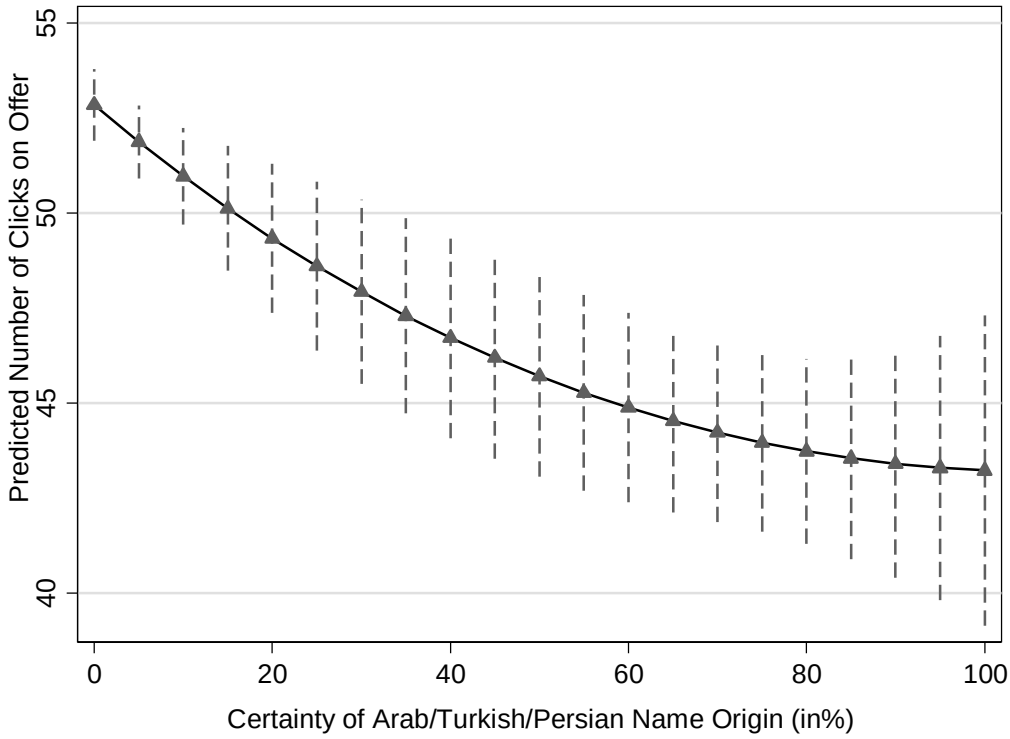


Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see full model in Table A3 in the Appendix). N= 17,294. Group differences are statistically different ($p<0.05$).

Figure 4 reports the result for the continuous measure of Arab/Turkish/Persian name origin (the percentage of survey respondents who rated the name to be typically Arab/Turkish/Persian). Disparities between Arab/Turkish/Persian and German drivers increase with the degree of certainty that the name is associated with an Arab/Turkish/Persian background (see Figure 4).

In the second part of the analysis, we turn to theoretical mechanisms. The findings largely support assumptions underlying statistical discrimination. Our tests suggest that disparities between groups depend on the variation of information about individual drivers. Figure 5 shows that drivers with an Arab/Turkish/Persian name are disadvantaged against German drivers when they have no or low ratings.

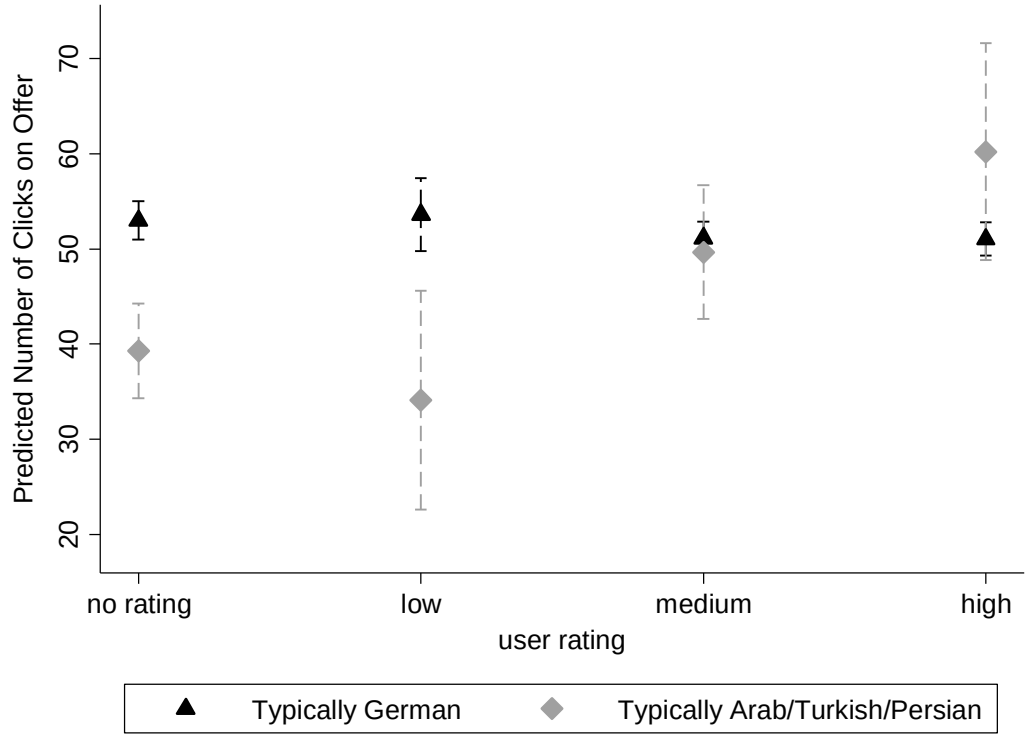
Figure 4: Predicted Number of Clicks on Offer by Certainty of Arab/Turkish/Persian Name Origin



Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Appendix). N= 17,294. Effect of continuous name measure is statistically significant ($p<0.01$). 95% confidence interval.

Disparities appear to vanish when both drivers have equally high user ratings. Similar results for the number of user ratings and the driver experience corroborate these findings (see Figure B2 and Figure B3 in the appendix). The findings for the user rating, number of ratings and experience suggest that customers place less weight on the name of the driver when other relevant information is available. This is consistent with the statistical discrimination hypothesis as the name of the driver is used as one more source of information about the perceived 'value' of the ride. Our tests do not allow to clearly distinguish which kind of stereotypes are driving unequal treatment. However, we conduct a number of additional indirect tests to approximate different motives (as discussed in section 2.1).

Figure 5: Predicted Number of Clicks on Offered Ride by Name Origin of the Driver and the User Rating



Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted for all observable characteristics (see Table A3 in the Appendix). N= 17,294. 95% confidence interval.

We suggested two possible sources of stereotypes. First, consumers may be concerned with safety since carpooling entails sharing a ride with a stranger. Given stereotypes regarding crime and driving styles among 'foreigners', we hypothesized that statistical discrimination may be driven by safety concerns. Our results provide indirect evidence that this is the case. Second, ethnic discrimination is substantial for males but disappears when comparing females (see Figure B4). This is consistent with the assumption that stereotypes regarding crime and driving styles apply particularly to male foreigners (Trager et al. 2014). Consumers may generally feel less safe with a male driver with an Arab/Turkish/Persian sounding name compared to a male German driver. However, female driver with an Arab/Turkish/Persian sounding name may not be disadvantaged compared to female German drivers given that the crime stereotype largely applies to males. Second, Arab/Turkish/Persian drivers without a profile picture are much more disadvantaged than drivers with a profile picture (see Figure

B5).[13] We interpret the profile picture to be a trust enhancing measure. Ethnic stereotypes regarding safety may simply have more room to engage imagination when users do not know what the driver looks like.

Third, we suspected that consumers may select rides based on sociability considerations. Statistical discrimination against drivers with an Arab/Turkish/Persian name could apply when customers assume that 'foreign' drivers may not speak the language or do not share similar music tastes which could make the joint ride less enjoyable. In fact, our findings show that Arab/Turkish/Persian drivers are less disadvantaged when they have indicated a preference for talking during the ride (see Figure B6). We speculate that consumers interpret a talking preference for foreigners as a sign of good German language skills. In contrast, a preference against talking may simply be interpreted as a potential language barrier. This could explain why the positive effect of talking preference on clicks is considerably larger for Arab/Turkish/Persian drivers compared to German drivers.

The results for music preference could be interpreted in a similar vein (See Figure B7). Our findings show that Arab/Turkish/Persian drivers are more disadvantaged when they indicate a preference for music during the ride. Again, customers may infer that a music preference implies a lack of willingness to talk which, in turn, could be perceived as cultural language barrier. In addition, customers may assume that drivers with an Arab/Turkish/Persian name may want to listen to ethnic music which could reduce the enjoyment of the ride for German customers who may be less likely to share similar tastes.

In sum, our results document ethnic discrimination in Germany's carpooling market. Our findings support assumptions consistent with the statistical discrimination theory. Furthermore, we explored which stereotypes drive statistical discrimination. We provided tentative evidence that safety and sociability considerations may drive statistical discrimination in our application.

5. Summary & Discussion

Recent ethnic discrimination studies increasingly make use of online market data to better understand when and why ethnic discrimination occurs. We aim to contribute to this effort with a novel application of ethnic discrimination in Europe's largest online carpooling market. We argue that there are three aspects that make our study a valuable contribution to existing research. *First*, carpooling is a social market as much as it is an economic market. This unique setting broadens the scope of ethnic discrimination research to more subtle, diverse and everyday interactions where ethnic minorities may face unequal treatment. Intergroup contact has been described as one effective strategy to reduce prejudice. Our results highlight the everyday processes that prevent intergroup contact from occurring in the first place.

Second, the social element of this market and the fact that we are able to measure all relevant observable characteristics allows us to test assumptions underlying taste-based and statistical discrimination, as well as particular stereotypes that drive the former. *Third*, the advantage of our application is that we observe real actors making real decisions in real markets while being able to control all relevant factors that may influence consumer choice.

We find evidence of substantial ethnic discrimination in Germany's carpooling market. Drivers with Arab/Turkish/Persian sounding names obtain – ceteris paribus – less demand (on average 12% less) compared to German drivers. The average Arab/Turkish/Persian driver in our analysis would have to offer his ride 3€ cheaper than the average German driver to achieve the same success, a discriminatory price premium that is equivalent to 23% of the price for an average ride.

Discrimination persists despite the relatively young and urban customer composition in this particular market. Therefore the estimated discrimination effect may be conservative compared to other everyday social interactions with ethnic minorities in the German society. Our study is consistent with other recent studies that show ethnic/racial discrimination effects in other online consumer markets (Ayres et al. 2011; Blommaert et al. 2014; Doleac & Stein

2013; Edelman et al. 2017; Przepiorka 2011; Robnett & Feliciano 2011; Zussman 2013). Discrimination against individuals with Arab, Persian and Turkish sounding names is consistent with findings in other studies across Europe (Blommaert et al. 2014; Gaddis & Ghoshal 2015; Rich 2014).

Our results largely support assumptions behind statistical discrimination theories. Ethnic disparities decrease or increase depending on the information that is provided about the service provider (the driver). Higher user ratings, a higher number of ratings and driver experience decrease ethnic discrimination. This shows that stereotypes regarding particular ethnic groups become more salient and active when other information that could signal trust is scarce. In other words, discrimination is more pervasive in information-scarce environments. Consumers appear to use the name origin as a signal for other relevant information that is otherwise not available.

Statistical discrimination assumes that discriminatory behavior is based on group-specific stereotypes which are commonly difficult to capture empirically. Our data allowed us to provide a number of indirect tests of underlying stereotypes that might drive discrimination. Unlike conventional studies in the area of employment, for example, stereotypes in carpooling do not (only) revolve around low productivity, low educational achievement or work ethics. Our analysis suggests that safety and sociability considerations apply. The results show that customers may have – ceteris paribus – less trust in a driver with a foreign name and that foreign drivers may signal a lower social value, for example, because they may speak a different language and prefer different music during the ride.

Our findings have implications for policy. First, the level of information provided matters for the degree of discrimination. This is a useful leverage point for policy makers. The risk for ethnic discrimination decreases with an increase of information about individual actors in a market environment. Growing evidence in support of statistical discrimination is good news for policy makers as information is often more malleable to policy than deep-seated prejudice.

Second, our findings further underscore the importance of a general discussion about anti-discrimination legislation in the internet age. It is possible that due to one-to-one communication in online markets, discrimination goes largely undetected and unsanctioned. The online apartment sharing platform Airbnb has recently published a report[14] on its effort to reduce racial discrimination in response to a study published by researchers at the Harvard Business School (Edelman et al. 2017). CEO Brian Chesky had previously called discrimination "the greatest challenge we face as a company" and hired former US attorney general Eric Holder to work on the problem.[15] The story was widely covered by mainstream media. As a result, the startup also adopted new non-discrimination policies and systems to address user complaints. Airbnb is now promising to allow guests to book without prior approval or screening by the host; reduce the prominence of pictures on guests' profiles in favor of more "objective", reputation-enhancing information.

Our study faces certain limitations. Unfortunately, information about the customers of the rides is not available. As such, we cannot directly correct entirely for ethnic selection on the demand side (e.g. Arab/Turkish/Persian riders may be more likely to prefer Arab/Turkish/Persian drivers). This limitation likely reduces our estimated discrimination effect and we therefore provide a conservative estimation. Due to data limitations, we were also not able to match more disaggregated regional population statistics. This information would allow us to disaggregate effects by location and look at how population attitudes may correlate with discriminatory behavior.

In summary, our results have illustrated the power of a name. We find that the name is used as a proxy for the trustworthiness of actors in a social market environment. Foreign-sounding drivers are trusted less than German drivers when information is scarce. When more information is provided about both drivers, discrimination disappears. In other words, when little is known about the quality of a ride, drivers with majority names enjoy a certain 'blind

trust premium' that cannot be explained by any relevant quality indicator. Unique to our social market scenario, we were able to provide indication that discrimination in social markets is based on assumptions regarding the social value of spending time with a member of an ethnic minority in terms of language barriers and tastes (e.g. music preference). Our findings highlight the role of ethnic discrimination in subtle, everyday social interactions between ethnic groups and provide an avenue for future research.

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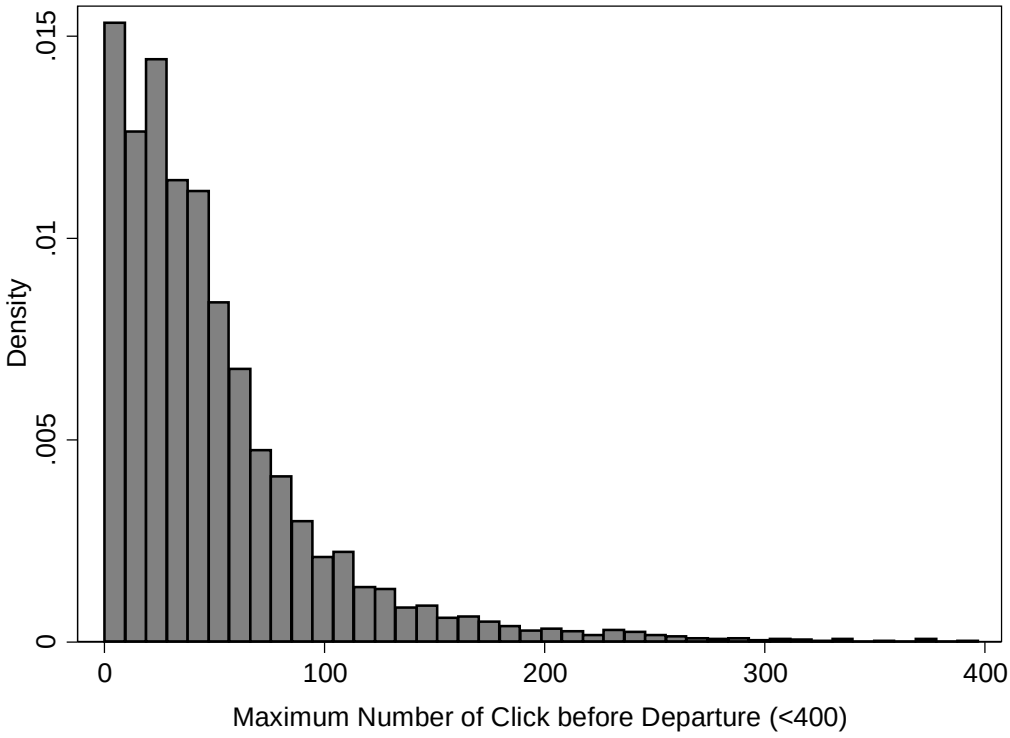
APPENDIX (in the order of appearance)

Figure B1: Distribution of Clicks



Source: Carpooling Data Germany 2015 (compiled by authors) (N=17,249, clicks above 400 clicks excluded for visualization purposes)

Table A1: Operationalization of model variables

Variable	Description	Operationalization (see also Table A3)
Dependent Variables		
Clicks	The maximum number of clicks an offered ride received before departure	Continuous
Independent Variable		
Name origin	Rated origin of the driver's name	Categorical: Arab/Turkish/ Persian vs. German (Continuous scale in Figure 4)
Controls		
Time of day	The time during a day when the ride departs	Categorical: night, morning, midday, afternoon, evening
Day of week	The day of the week when the ride departs	Categorical: Monday - Sunday
Distance in km	The distance between departure city and arrival city	Continuous
Price in euro	Price to be paid for one seat on the ride	Continuous
Gender	Gender of the driver	Categorical: Female, male
Age	Age of the driver	Continuous (in years)
Smoking preference	Smoking preference of the driver	Categorical: yes, no
Music preference	Music preference of the driver	Categorical: yes, no
Dialog preference	Dialog preference of the driver	Categorical: yes, no, maybe
Rating	Rating of the driver by previous customers	Categorical: no rating, low, medium, high
Experience	Experience of the driver based on the number of offered rides in the past	Categorical: 0 – no experience to 4 – high experience
Picture	Availability of a profile picture for the driver	Categorical: yes, no
Comfort	Comfort of the ride conditional of the type of car	Categorical: simple/normal, comfortable, luxury, score not available
Auxiliary Variables		
Route ID	Control for routes between cities	Dummy variable
Ride Volume	Control for number of rides offered per route	Continuous variable
Days until departure	Number of days before departure (i.e. the time the offer was online before departure)	Continuous variable

Table A2: Summary Statistics of Clicks Model (see Figure 3 and Table A3)

	German				Arab/Turkish/Persian			
	mean	*sd*	*min*	*max*	*mean*	*sd*	*min*	*max*
Maximum Number of Clicks on Offer	51.3	54.1	0	629	46.2	49.5	0	331
Traffic volume	15.9	11.8	2	58	12.3	9.8	2	58
Days online until departure	3.4	2.7	0	11	4.2	3.2	0	11
Female	0.3	0.4	0	1	0.1	0.2	0	1
Age	31.3	9.7	18	101	31.3	7.1	18	54
Number of Ratings	5.4	12.0	0	190	4.4	10.5	0	79
User Rating								
No rating	0.4	0.5	0	1	0.4	0.5	0	1
Low	0.0	0.2	0	1	0.1	0.2	0	1
Medium	0.3	0.5	0	1	0.3	0.5	0	1
High	0.3	0.4	0	1	0.2	0.4	0	1
Experience	1.1	1.2	0	4	0.9	1.1	0	4
Profile picture	0.4	0.5	0	1	0.4	0.5	0	1
Smoking preference	0.0	0.2	0	1	0.1	0.3	0	1
Music preference	0.4	0.5	0	1	0.4	0.5	0	1
Talking preference								
maybe	0.9	0.3	0	1	0.8	0.4	0	1
yes	0.1	0.3	0	1	0.2	0.4	0	1
no	0.0	0.2	0	1	0.1	0.2	0	1
Car comfort								
simple/normal	0.5	0.5	0	1	0.3	0.5	0	1
comfortable	0.2	0.4	0	1	0.2	0.4	0	1
luxury	0.0	0.2	0	1	0.1	0.3	0	1
n/a	0.2	0.4	0	1	0.4	0.5	0	1
Nighttime	0.0	0.2	0	1	0.1	0.3	0	1
Morning	0.2	0.4	0	1	0.1	0.3	0	1
Midday	0.2	0.4	0	1	0.2	0.4	0	1
Afternoon	0.4	0.5	0	1	0.4	0.5	0	1
Evening	0.1	0.4	0	1	0.2	0.4	0	1
Sunday	0.3	0.4	0	1	0.2	0.4	0	1
Monday	0.1	0.3	0	1	0.1	0.3	0	1
Tuesday	0.0	0.2	0	1	0.1	0.2	0	1
Wednesday	0.1	0.2	0	1	0.0	0.2	0	1
Thursday	0.1	0.3	0	1	0.2	0.4	0	1
Friday	0.3	0.4	0	1	0.2	0.4	0	1
Saturday	0.1	0.3	0	1	0.1	0.3	0	1
Distance in km	260.3	153.9	36	1178	289.8	168.3	39	653
Price in Euro	13.3	7.9	1	58	14.9	8.7	1	40
N	16.766				528			

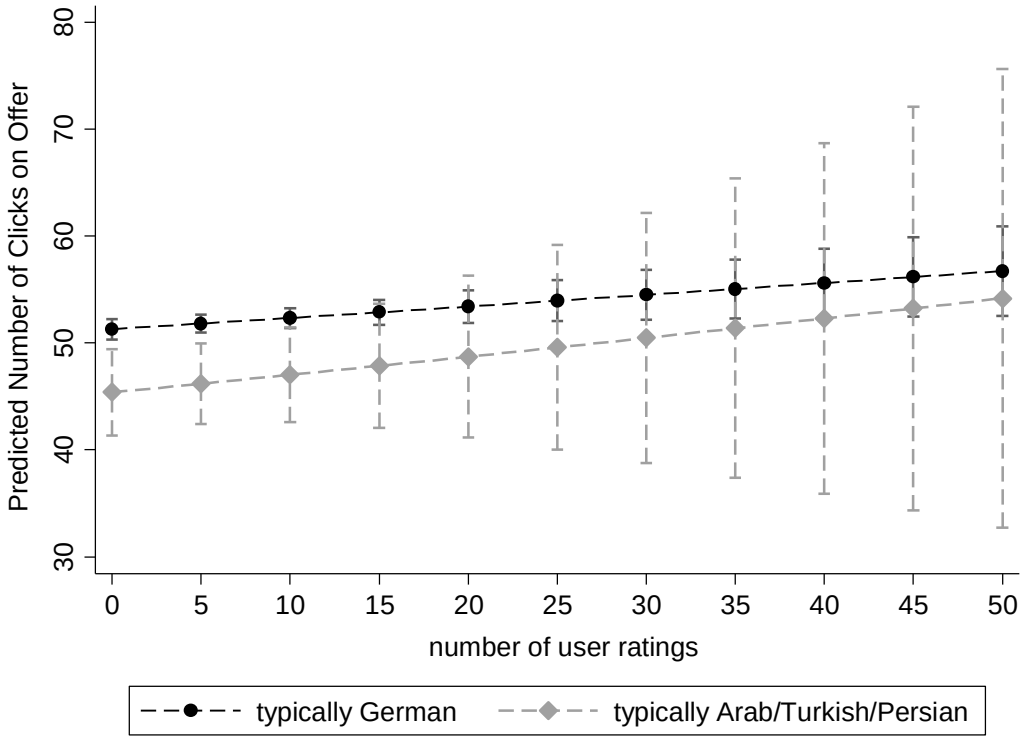
Table A3: The effect of name origin on clicks – all model coefficients (Average Marginal Effects)

		Empty Model	Full Model
Arab/Turkish/Persian name		-6.126**	-5.673**
		(1.91)	(1.95)
Number of rides per route		0.0675	-0.0993*
		(0.04)	(0.05)
Days since upload		-2.711***	-2.763***
		(0.15)	(0.16)
Time of day (ref. night)			
	morning		-3.149
			(2.05)
	mid-day		-2.306
			(2.02)
	afternoon		-2.512
			(2.09)
	evening		-8.868***
			(2.03)
Day of week (ref. Sunday)			
	Monday		-5.420***
			(1.40)
	Tuesday		-9.867***
			(1.81)
	Wednesday		-6.911***
			(1.85)
	Thursday		-10.47***
			(1.31)
	Friday		-2.609*
			(1.09)
	Saturday		-6.682***
			(1.45)
Distance in km			0.284***
			(0.02)
Price in euro			-1.833***
			(0.19)
Female			4.273***
			(0.91)
Age			-0.00172
			(0.04)
Number of user ratings			0.106*
			(0.04)
Rating (ref. no rating)			
	low		0.217
			(2.07)
	medium		-1.374
			(1.58)
	high		-1.298
			(1.51)

Experience (ref. Newcomer)		
Intermediate		0.314
		(1.48)
Experienced		1.915
		(1.76)
Expert		1.876
		(1.87)
Ambassador		7.378**
		(2.82)
Profile picture available		1.200
		(0.83)
Smoking preference (ref. No/ Maybe)		
Yes		2.589
		(1.91)
Music (Maybe/No		
Yes		0.855
		(0.84)
Dialog (ref. Maybe)		
Yes		5.600***
		(1.46)
No		1.626
		(1.91)
Car comfort (ref. simple/normal)		
Comfortable		-1.228
		(0.94)
Luxury		2.361
		(2.04)
n/a		-2.085*
		(0.98)
Observations	17294	17294
AIC	170060	169589
BIC	170836	170597

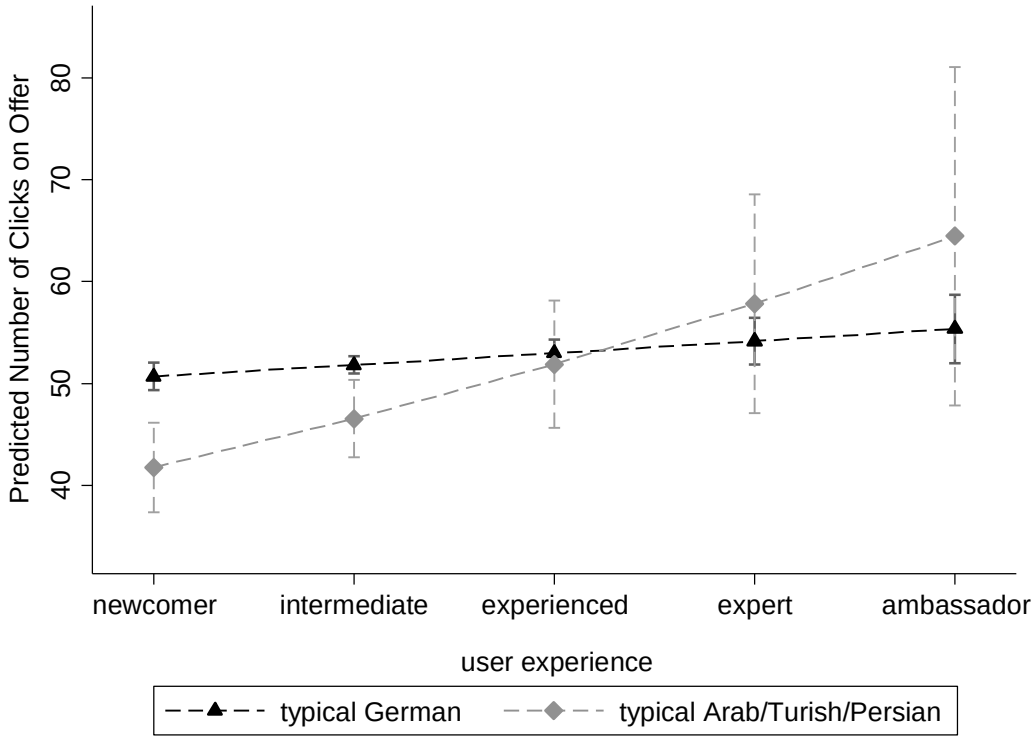
Note: AMEs based on Negative Binomial Regression model, standard errors in parentheses. Coefficients for auxiliary variables (i.e. route id) not reported. *** p<0.01; ** p< 0.05; * p< 0.1. Source: Carpooling Data Germany 2015 (compiled by authors)

Figure B2: Predicted Number of Clicks on Offered Ride by User Name Origin and Number of User Ratings



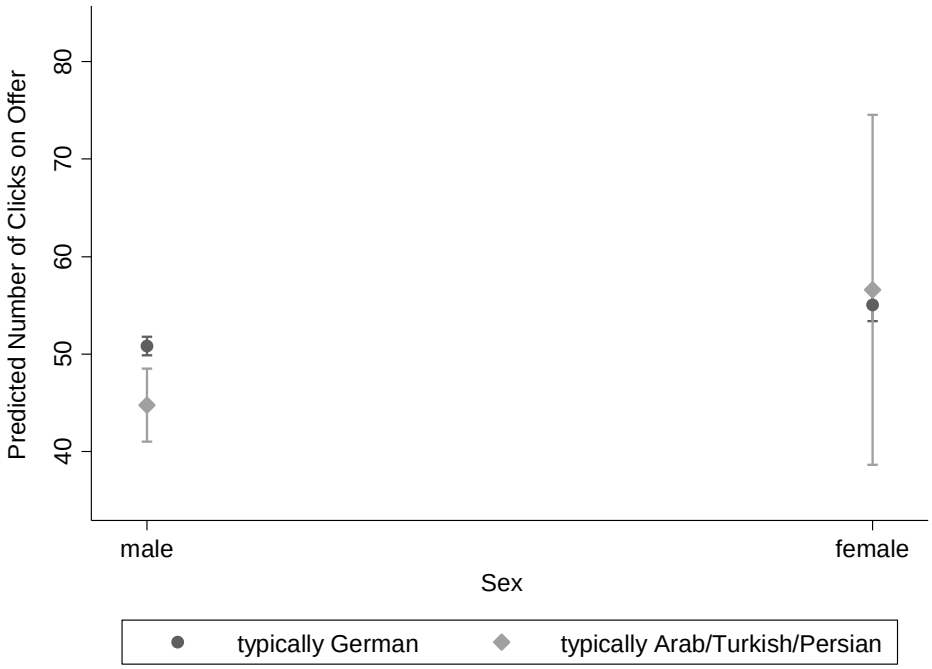
Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Appendix). N= 17,294. 95% confidence interval.

Figure B3: Predicted Number of Clicks on Offered Ride by User Name Origin and Driver Experience



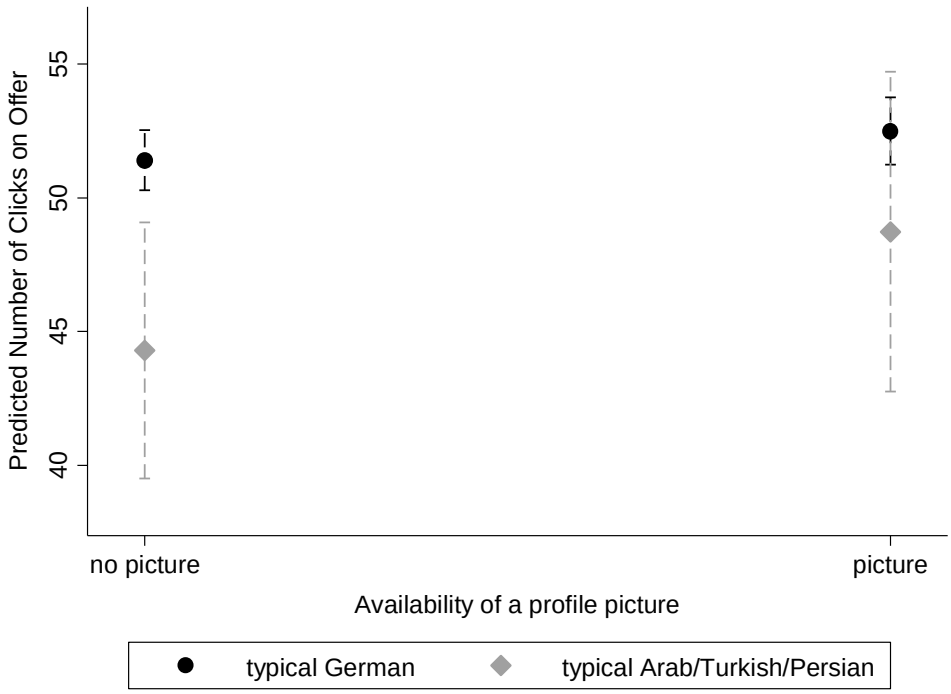
Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Appenidx). N= 17,294. 95% confidence interval.

Figure B4: Predicted Number of Clicks on Offered Ride by Name Origin and Sex



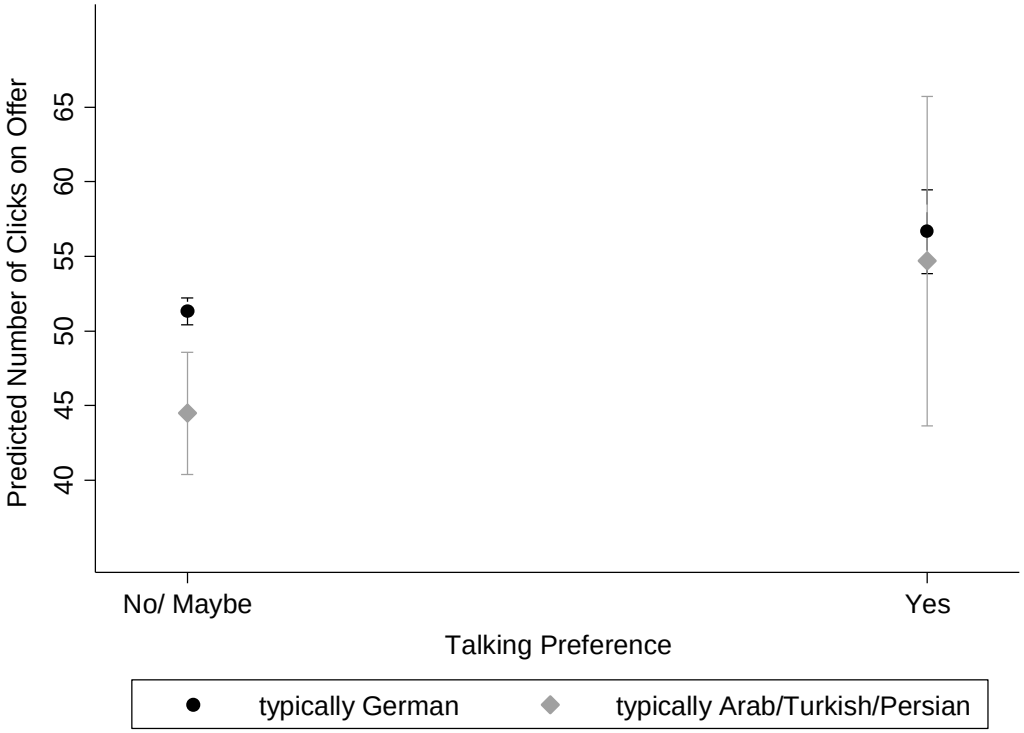
Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Annex). N= 17,294. 95% confidence interval.

Figure B5: Predicted Number of Clicks on Offered Ride by Name Origin and Profile Picture



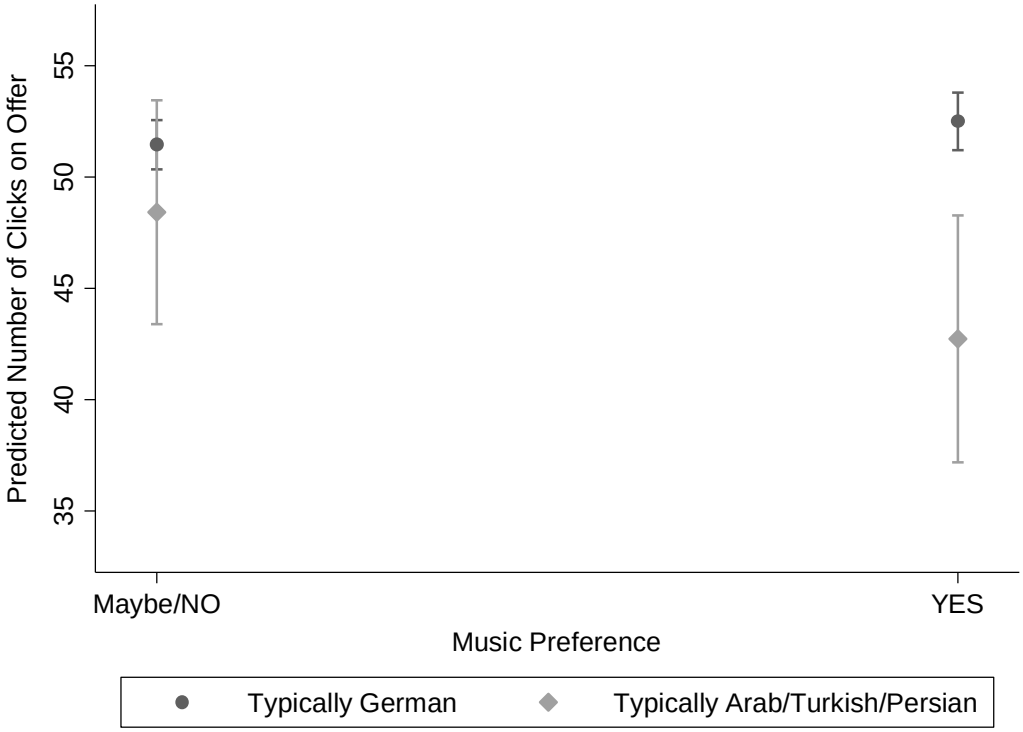
Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Annex). N= 17,294. 95% confidence interval.

Figure B6: Predicted Number of Clicks by Name Origin and Talking Preference



Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Annex). N= 17,294. 95% confidence interval.

Figure B7: Predicted Number of Clicks by Name Origin and Music Preference



Note: Carpooling Data Germany 2015 (compiled by authors). Predicted clicks are adjusted (see Table A3 in the Annex). N= 17,294. 95% confidence interval.

Endnotes

[1] The exact origin of Arab, Persian and Turkish names is difficult to distinguish for a lay person. However, member of all three groups in Germany are commonly associated to be of the same migrant group with assumed cultural similarities.

[2] See article in the German newspaper *die Welt* entitled „BlaBlaCar und Co. vor diesen hippen Mitfahrdiensten zittert die Bahn“ (i.e. these are the carpooling services that the train companies are afraid of). Accessible at https://www.welt.de/wirtschaft/article129721188/Vor-diesen-hippen-Mitfahrdiensten-zittert-die-Bahn.html.

[3] As a pre-test, we uploaded a limited number of artificial rides on the route Munich to Cologne, varying profiles by the name origin only (using ‘Mehmet’ and ‘Serkan’ as typical Turkish first names and ‘Johannes’ and ‘Tobias’ as typical German first names). The pre-test indicated large discrimination effects which further strengthened our objective to collect real market data.

[4] See Heckman 1998 and Neumark, D. (2012) for discussions on the limitations of audit and correspondence studies.

[5] Other forms of discrimination include implicit, unintentional biases (e.g. Anderson, Fryer, & Holt, 2006). We will focus our discussion on statistical and taste-based discrimination as the decision to car-pool (our application) involves conscious weighing of numerous alternatives (other competing rides) and evaluation of several characteristics (location, price, timing, age, experience, rating et cetera).

[6] See news articles referring to the issue of crimes rates and foreigners in Germany: http://www.strafrecht-wi.de/auslaenderkriminalitaet/; http://www.bpb.de/politik/innenpolitik/innere-sicherheit/76639/auslaenderkriminalitaet?p=all;

http://www.spiegel.de/lebenundlernen/schule/kriminalitaet-von-migranten-laut-gutachten-nicht-hoeher-a-983536.html

[7] See news report covering a survey on the reputation of car drivers in different European countries: https://www.welt.de/motor/news/article108612704/Europaweite-Umfrage.html

[8] Stereotypes regarding high crime rates for ethnic minorities largely affect males (Trager et al. 2014)

[9] We would like to thank the provider for supporting academic research by allowing access to this data.

[10] Goodness of Fit tests revealed that negative binomial regression is superior to other count models.

[11] There is generally less demand for carpooling in rural areas. Ethnic minority drivers are also less often offer rides on rural routes. Including rural routes would hence bias the average number of clicks for German drivers downward.

[12] Raters were paid for their efforts and consisted mostly of students from laboratory pools at the University of (…) and the University of (…) (all in Germany). We thereby guaranteed that no rater participated more than once. The raters did not receive information on the aim of the study to avoid demand effects. More technical information available upon request.

[13] We also estimated the baseline model based on a subsample of rides with a profile picture (N= 7,664; Arab/Turkish/Persian=233). The effect of an Arab/Turkish/Persian name is smaller and not significant.

[14] Report accessible at http://blog.atairbnb.com/wp-content/uploads/2016/09/REPORT_Airbnbs-Work-to-Fight-Discrimination-and-Build-Inclusion.pdf; last accessed on 26 May 2017.

[15] See http://blog.airbnb.com/an-update-on-the-airbnb-anti-discrimination-review; https://www.theguardian.com/technology/2016/jul/20/airbnb-hires-eric-holder-racial-discrimination-bias