

**Attention Discrimination:  
Theory and Field Experiments with Monitoring Information  
Acquisition\***

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**Abstract**

We link two important ideas: attention is scarce and lack of information about an individual drives discrimination in selection decisions. Our model of allocation of costly attention implies that applicants from negatively stereotyped groups face “attention discrimination”: less attention in highly selective cherry-picking markets, where more attention helps applicants, and more attention in lemon-dropping markets, where it harms them. To test the prediction, we integrate tools to monitor information acquisition into correspondence field experiments. In both countries we study we find that unfavorable signals, minority names, or unemployment, systematically reduce employers’ efforts to inspect resumes. Also consistent with the model, in the rental housing market, which is much less selective than labor markets, we find landlords acquire more information about minority relative to majority applicants. We discuss implications of endogenous attention for magnitude and persistence of discrimination in selection decisions, returns to human capital and, potentially, for policy.

**Keywords:** attention, discrimination, field experiment, monitoring information acquisition

**JEL codes:** C93, D83, J15, J71

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## I. INTRODUCTION

Understanding why people discriminate based on ethnicity, gender or other observable group attributes has been one of the central topics in economics and other social sciences for decades.<sup>1</sup> Since the seminal work of Phelps (1972) and Arrow (1973), it has been widely acknowledged that due to a lack of individual-level information decision makers often rely on a group attribute as a signal of unobserved individual characteristics. This may give rise to “statistical discrimination” in decisions of whether to hire, rent an apartment, provide a loan or admit an individual to a university, to name a few examples.<sup>2</sup> At the same time, a large body of research in both economics and psychology shows that scarce attention plays an important role in decision making (e.g., Newell, Shaw and Simon 1958, Kahneman 1973, Gabaix, Laibson, Moloche and Weinberg 2006, Mackowiak and Wiederholt 2009, Caplin and Dean 2014).

While the existing models of statistical discrimination implicitly assume that individuals are fully attentive to available information, we link the two important literatures. We develop a model in which we describe how knowledge of a group attribute impacts the level of attention to information about an individual and how the resulting asymmetry in acquired information across groups—denoted “attention discrimination”—can lead to discrimination in a selection decision. We test the model with three correspondence field experiments in two countries. A novel feature of the field experiments are the tools to measure the process of decision-making, in addition to selection choices, by monitoring acquisition of information about applicants.

Attention to available information about candidates is crucial input in virtually any selection process. The Economist (2012), for example, describes the process as follows: “*They [human resource staff] look at a CV for ten seconds and then decide*

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<sup>1</sup> Researchers have produced a vast amount of evidence documenting discriminatory behavior based on ethnicity or gender. Yinger (1998) and Altonji and Blank (1999) survey regression-based (non-experimental) evidence, Riach and Rich (2002) and List and Rasul (2011) provide a recent summary of related field experiments.

<sup>2</sup> Taste-based discrimination is the second prominent explanation for why people discriminate (Becker 1971). It arises due to preferences, not due to lack of information.

*whether or not to continue reading. If they do, they read for another 20 seconds, before deciding again whether to press on, until there is either enough interest to justify an interview or to toss you into the 'no' pile.*” The influential field experiment in the US labor market by Bertrand and Mullainathan (2004) finds that returns to sending higher-quality resumes, in terms of callbacks, are higher for applicants with a White-sounding name compared to applicants with an African-American-sounding name. The pattern is consistent with lexicographic searches: employers stop reading once they see an African-American name on a resume, thus resulting in greater discrimination among more qualified applicants. These findings highlight the need to find a way to measure the effect of name on reading effort, and for a theory, the findings open the question as to whether choices about inspecting applicants are guided by the expected benefits of reading, as indicated by the qualitative description from practitioners.

To illustrate how allocation of attention and statistical discrimination interact, we propose a new model. First, acquiring information is costly and decision makers optimize how much information to acquire based on expected net benefits. This leads to “attention discrimination”. Second, imperfect information affects selection decisions because the less the decision maker knows about an individual, the more he relies on observable group attributes when assessing individual quality. Putting these two key features together, the endogenous attention magnifies (in most types of markets) the impact of prior beliefs about group quality, and discrimination in selection decisions can persist even if perfect information about an individual is readily available, if it is equally difficult to screen individuals from dissimilar groups and if there are no differences in taste. It also implies lower returns to employment qualifications for negatively stereotyped groups in selective markets, and for policy the important role of the timing of when a group attribute is revealed.

The model provides the following testable prediction. In “cherry-picking” markets where only top applicants are selected from a large pool of candidates (e.g., much of the labor market, admission to top schools, the scientific review process in leading scholarly journals), decision makers should favor acquiring information about individuals from a group that looks a priori “better,” whereas in “lemon-dropping”

markets where most applicants are selected (e.g., the rental housing market, admissions to nearly open-access schools), decision makers benefit more from acquiring information about individuals from a group with negative stereotypes. This is because more information should be acquired when its expected benefits are higher, which is when there is a higher chance that the informed decision differs from the status quo, i.e. when there is a higher chance of accepting the applicant in the market where most applicants are rejected and vice versa.

We test the predictions of the model by monitoring information acquisition in three field experiments—in rental housing and labor markets in the Czech Republic and in the labor market in Germany. We send emails responding to apartment rental advertisements and to job openings. In each country we study discrimination against negatively stereotyped ethnic minorities and randomly vary the names of fictitious applicants. In the German labor market we also vary the quality of applicants by signaling recent unemployment in the email. To monitor information acquisition in the labor market, employers receive an email application for a job opening, which contains a hyperlink to a resume. Similarly, in the housing market landlords can click on a hyperlink located in the email and learn more on an applicant’s personal website. We monitor whether employers and landlords open the applicant’s resume (resp. website) as well as the intensity of information acquisition.

While we find strong evidence of discrimination against minorities in selection decisions on both the housing and labor markets, we also document that systematic discrimination arises even earlier, during the process of information acquisition. The key findings on attention allocation are as follows. In the labor markets in both countries, employers put more effort to opening and reading resumes of majority compared to minority candidates, while on the rental housing market landlords acquire more information about minority compared to majority candidates. Signaling unemployment lowers attention to an applicant’s resume, similarly as minority name does. The set of results on attention allocation is consistent with the proposed model of statistical discrimination with endogenous attention. The labor markets we study are very selective, as indicated by low invitation rates, and decision makers acquire *less* information about a priori less attractive applicants, whether it be a person with

minority ethnic status or unemployed. In contrast, the rental housing market is not selective and decision-makers acquire *more* information about applicants who look a priori less attractive. Later, we also discuss alternative explanations.

Methodologically, our paper contributes to efforts to test theory with enhanced measurement tools. In the lab, researchers have fruitfully complemented choice data with measures of the decision-making process to sort through alternative theoretical explanations of observed behavior. These techniques involve eye-tracking (Knoepfle, Wang and Camerer 2009, Arieli, Ben-Ami and Rubinstein 2011, Reutskaja, Nagel, Camerer and Rangel 2011) or its computer-based analog mouse-tracking, pioneered by Camerer, Johnson, Rymon and Sen (1993) and later used most prominently by Costa-Gomes, Crawford and Broseta (2001), Costa-Gomes and Crawford (2006), Gabaix, Laibson, Moloche and Weinberg (2006), and Brocas, Carrillo, Wang and Camerer (2010).<sup>3</sup> Camerer and Johnson (2004) and Crawford (2008) summarize how progress in testing theories of human behavior has been facilitated by using information acquisition measures. To the best of our knowledge, ours is the first study that integrates monitoring information acquisition, in addition to selection decisions, into a field experiment.

In order to identify discrimination based on ethnicity, gender, caste or sexual orientation in the labor and housing markets, previous correspondence experiments estimated the effects of a group-attribute signal (mostly names) in applications (e.g., Jowell and Prescott-Clark 1970, Weichselbaumer 2003, Bertrand and Mullainathan 2004, Ahmed and Hammarstedt 2008, Banerjee, Bertrand, Datta and Mullainathan 2009, Hanson and Hawley 2011, Kaas and Manger 2012). These experiments measure the likelihood of callback (or invitation) as the outcome of interest.<sup>4</sup> We offer an

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<sup>3</sup> Mouse-tracking typically uses the Mouselab software, which displays information hidden in boxes on the computer screen and then tracks which and how many pieces of information subjects acquire. Other process tracking techniques include recording people talking aloud while thinking (Ericsson and Simon 1980), watching the physical retrieval of information (Payne 1976) and monitoring eye movements with pupil dilation measures (Wang, Spezio and Camerer 2010) and brain activity (Bhatt and Camerer 2005).

<sup>4</sup> An important exception is Milkman, Akinola and Chugh (2012) who study race and gender discrimination in academia and measure not only callback of faculty members reacting to students' requests to meet but also analyze the speed of their reply. Conditional on receiving a callback, in our experiments we do not find any significant difference in response speed across ethnic groups.

extension of this widely-used design by measuring effort to open and read resumes in the labor market and to acquire information about potential tenants in the rental housing market.<sup>5</sup>

Our model of attention discrimination contributes to existing theories of discrimination (for a recent survey see Lang and Lehmann 2012). It is related most closely to “screening discrimination” (Cornell and Welch 1996), in which the key assumption is that it is more difficult to understand signals from a culturally dissimilar group (Lang 1986). Also, social psychologists have argued (for references see Stanley, Phelps and Benaji 2008) that due to negative unconscious attitudes—“implicit discrimination”—people often use simple decision rules biased against negatively stereotyped groups, which may result in little effortful scrutiny of relevant information. In our model, differences in acquired knowledge are an outcome of the agent’s choice and can arise even if the provided signals are equally informative across groups and there are no unconscious biases in attention. This approach relates our model to growing literature on rational inattention that uses an optimizing framework to study the effects of limited attention to the available information on a range of (mostly macroeconomic) phenomena (e.g., Sims 2003, Mackowiak and Wiederholt 2009, Woodford 2009, Nieuwerburgh and Veldkamp 2010, Matějka and Sims 2011, Matějka and McKay 2012, Caplin and Dean 2014).

The rest of the paper is organized as follows. In Section II we develop a model of an inattentive agent who decides how much to learn about an applicant and we describe how “attention discrimination” can arise and its implications for discrimination in selection decisions. We also formulate testable predictions for the field experiments. Sections III-V detail the experimental designs and present empirical results in the rental housing and labor markets. Section VI provides a

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<sup>5</sup> The effort to better inform theories of discrimination by collecting novel types of data and performing experiments across distinct markets relates our work to List (2004), who combines a natural field experiment with artefactual field experiments to distinguish between taste-based and statistical discrimination in a product market, and to Gneezy, List and Price (2012), who measure discrimination based on disability, gender, race and sexual orientation across several markets to understand how the controllability of a group attribute affects discrimination.

discussion about how the results map on the proposed model and alternative interpretations. Section VII concludes.

## II. THE MODEL OF ATTENTION DISCRIMINATION

We model a decision maker's (DM) binary choice about an applicant. The applicant is of an inherent quality  $q$  for the DM, which is unknown to the DM. The quality  $q$  summarizes any multidimensional characteristics of the applicant, which can include skill, work ethic, reliability, or even the DM's taste for the applicant's ethnicity or the taste of individuals with whom the DM interacts, e.g. customers or neighbors. The more attention the DM pays to the applicant the better knowledge of the quality he acquires, but doing so is costly. Let the DM maximize the expected payoff of the selected alternative less the cost of information, where the structure of the DM's payoff is as follows:

$$payoff = \begin{cases} q & \text{if the DM accepts the applicant} \\ R & \text{if the DM rejects the applicant.} \end{cases}$$

Accepting the applicant generates a payoff that is equal to the applicant's quality, while rejecting the applicant generates a reservation payoff  $R$ ; it is a payoff from entertaining a reservation option.<sup>6</sup>

The DM faces two choices. First, he chooses how much information about the applicant to acquire, i.e. how much attention to pay to the applicant, which determines the precision of his knowledge about  $q$ , e.g. whether and in how much detail to read the applicant's resume. Second, he decides whether to accept the applicant or not. Except for the DM's choice of attention level, i.e. the endogeneity of the precision of his knowledge about  $q$ , the model is analogous to the standard model of statistical discrimination (Phelps 1972).

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<sup>6</sup> This reservation payoff depends on the specifics of the DM's situation, but its magnitude is not important for the model. The only thing that is important is that the DM selects against some given alternative. The reservation payoff can even describe a continuation value in case that this single selection decision is a part of a more complicated selection process with more applicants that the DM faces successively. All the results would go through if the reservation payoff were normalized to zero, for instance.

The DM first observes the applicant's group of ethnic origin  $G$ . Let us assume that the quality in group  $G$  is distributed according to  $N(q_G, \sigma_G^2)$ , which is known by the DM and it becomes the DM's prior knowledge about  $q$ . For our purposes this is equivalent to assuming that the DM only gets an imperfect signal on the ethnicity, e.g. reads the applicant's name. Next, the DM has an option to receive an additional independent signal  $y$  on the applicant's quality such that

$$y = q + \varepsilon,$$

where  $\varepsilon$  is a normally distributed error term,  $N(0, \sigma_\varepsilon^2)$ ;  $\sigma_\varepsilon^2$  is selected by the DM and it determines the incurred information cost. Then, the DM forms his knowledge according to Bayes law. Upon receiving signals  $G$  and  $y$  the DM's posterior belief about the quality is given by  $N(q', \xi\sigma_G^2)$ , where

$$q' = \xi y + (1 - \xi)q_G. \quad (1)$$

The weight  $\xi = \frac{\sigma_G^2}{\sigma_G^2 + \sigma_\varepsilon^2} \in [0, 1]$  measures the attention level and also the informativeness of the applicant-specific signal  $y$  relative to that of ethnic origin  $G$ . Equation (1) implies that observing that the applicant belongs to a group with a lower mean quality  $q_G$  lowers  $q'$ ; the lower the attention level  $\xi$  to the individual characteristics, the stronger the effect. Finally, the DM accepts the applicant if and only if the expected quality according to the DM's posterior is higher than the reservation payoff, i.e.  $q' > R$ .

In general, the cost of acquiring information can take many different forms. Let  $\xi$  be the DM's choice, let  $M(\xi)$  be the cost of information and  $\Pi(\xi)$  be the expected payoff given the selected level of precision. Let  $S \subseteq [0, 1]$  be the set of available precision levels, on which the cost  $M$  is defined.<sup>7</sup>

**DEFINITION** (*the DM's problem*)

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<sup>7</sup> In case that the DM faces an observation cost  $\lambda$  from observing the quality,  $S = \{0, 1\}$ ,  $M(0) = 0, M(1) = \lambda$ . The technology driven by collecting a number of equally costly independent Gaussian signals would imply  $S = ]0, 1[$ ,  $M(\xi) = \frac{\lambda}{1-\xi}$ , and for rational inattention  $S = ]0, 1[$ ,  $M(\xi) = \lambda \log \frac{1}{1-\xi}$ .



First, the attention level  $\xi$  is selected according to:

$$\xi = \operatorname{argmax}_{\xi \in S} \Pi(\xi) - M(\xi). \quad (2)$$

Then, upon receiving new information, the DM accepts the applicant if and only if

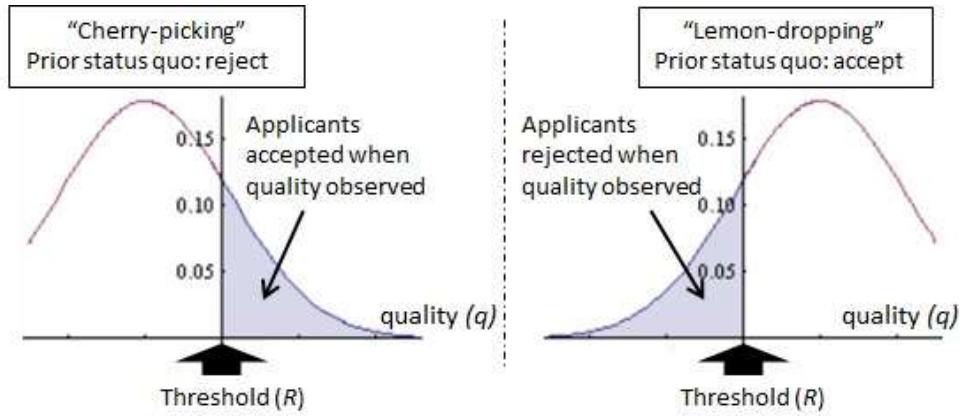
$$\xi q + \xi \varepsilon + (1 - \xi)q_G > R, \quad (3)$$

where  $q$  is the applicant's true quality and  $\varepsilon$  is drawn from  $N(0, (1/\xi - 1)\sigma_G^2)$ .

The expected payoff  $\Pi(\xi)$  equals  $\max(q', R)$ , expected payoffs after a selection decision, integrated over the realizations of  $q'$ . Equation (3) expresses  $q' > R$  using equation (1). From now on we assume that  $M$  and  $S$  are such that an optimal  $\xi$  always exists, e.g.  $S$  is a finite set, or it is compact and  $M$  is continuous.

Proposition 1 below describes the solutions and a new channel through which discrimination can operate: costly attention. It addresses how beliefs affect attention and also how endogenous attention affects discrimination in the selection decision. We distinguish between three types of markets, i.e. the DM's selection situations: highly selective "cherry-picking" markets where few applicants are accepted and the means of priors for all considered groups are below the threshold  $R$ , "lemon-dropping" markets with all the means being above the threshold, and "middle" markets where some groups have mean qualities above the threshold and some under. Figure 1 presents two situations that differ in the selectivity. In the following text we introduce group  $P$ , an alternative to  $G$ , which determines a different DM's prior. It can be a group of a different ethnic origin, or even the general population of which the applicant is considered to be a member in case the DM does not receive any signal on the applicant's ethnicity. We assume  $q_G < q_P$  and  $\sigma_G^2 = \sigma_P^2$ , i.e.  $G$  is the disadvantaged group.

**Figure I:** Expected Benefits from Information Acquisition in Two Markets of Different Selectivity Levels



**PROPOSITION 1 (attention discrimination)**

- A) In the “cherry-picking” markets, i.e.  $q_G < q_P < R$ , an applicant from group  $G$  is paid (weakly) less attention than an applicant from group  $P$ , and endogenous attention increases discrimination in the selection decision.
- B) In the “lemon-dropping” markets, i.e.  $R < q_G < q_P$ , an applicant from group  $G$  is paid (weakly) more attention than an applicant from group  $P$ , and endogenous attention increases discrimination in the selection decision.
- C) In the “middle” market, i.e.  $q_G < R < q_P$ : if  $|q_G - R| < |q_P - R|$ , then an applicant from group  $G$  is paid (weakly) more attention than an applicant from group  $P$ , and endogenous attention decreases discrimination in the selection decision; if  $|q_G - R| > |q_P - R|$ , then an applicant from group  $G$  is paid (weakly) less attention and endogenous attention increases discrimination in the selection decision.

Proof: Supplementary material.

The statement that endogenous attention increases, resp. decreases, discrimination means the difference in acceptance probability between an applicant from group  $P$  and group  $G$  is (weakly) higher, resp. lower, than if attention  $\xi_G$  were exogenously fixed at the level of attention  $\xi_P$  paid to group  $P$ .

The results in Proposition 1 are driven by two effects. See Lemmas 1 and 2 in the Supplementary material. First, the optimal level of attention decreases with  $|q_G - R|$ , the distance of mean quality of a group from the threshold. Second, for

$q_G < R$ , groups below the threshold, more attention increases the probability that an individual from the group is accepted, and the result is opposite for  $R < q_G$ .

The first effect is driven by the fact that more information is acquired if the expected benefit from new information is higher. The further away are the DM's prior beliefs from the decision threshold, i.e. the more certain he is a priori, the less likely it is that any new information affects the DM's final selection decision. This effect can be seen in Figure 1, as the shaded areas (where the DM would change his decision upon perfect information) diminish if the prior mean moves further away from the threshold. On highly selective "cherry-picking" markets, from ex ante perspective it is a waste to acquire costly information about these individuals that a priori seem (due to their group attribute) even more likely than others that they are not suitable for acceptance. On the other hand, on thin "lemon-dropping" markets, it is wasteful to pay attention to the exceptionally good groups, and the DM is more prone to accept them without going through the costly information acquisition.

The second effect is that if more additional information is acquired, the more the DM relies on this information and prior knowledge driven by the group attribute has lower impact. For instance, when prior beliefs suggest quality below the threshold, then the applicant would always be rejected if no additional information were acquired, while he has a chance of being accepted if he is paid positive attention.<sup>8</sup>

Proposition 1 provides the main testable implication of how beliefs affect attention. Our model implies that the level of attention can vary across groups and that the ranking of groups by attention and by the precision of information can be opposite across markets, which is what we test in the experiments. The group with the lower mean is further away from the threshold and thus is paid less attention in a highly selective market, while in the "lemon dropping" market the group with a lower mean is closer to the threshold and is paid more attention.

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<sup>8</sup> This can be gauged from Equation (1), which implies that for group  $G$  the posterior means  $q'$  are drawn from  $N(q_G, \xi\sigma_G^2)$ . Higher attention increases the variance of the posterior means.

The attention discrimination driven by differences in the mean qualities of different groups affects the disadvantaged groups more negatively in both the “lemon dropping” and “cherry picking” markets and thus increases discrimination in the selection decision. If the group mean is below the quality threshold, then more information increases the probability that an applicant is accepted and vice versa.<sup>9</sup> The disadvantaged group  $G$ , i.e.  $q_G < q_P$ , according to Proposition 1, is paid less attention than group  $P$  on highly selective markets—where higher attention increases the probability of acceptance—and more attention on the “lemon-dropping” markets, where attention decreases the probability of acceptance. The endogenous attention thus increases the difference of the probabilities of acceptance between the two groups relative to when attention  $\xi_G$  is equal to  $\xi_P$ . In some cases, however, the endogenous attention can decrease discrimination. This is on the “middle” markets if  $|q_G - R| < |q_P - R|$ . In that case, the DM chooses to pay more attention to  $G$ , which is below the threshold where additional attention is advantageous.

If the costs of information acquisition are varied, then the size of attention discrimination changes. When the costs are zero, resp. infinite, there is no attention discrimination as the DM pays full attention, resp. no attention, to all groups. Therefore, for instance in the “cherry-picking” market, if the costs are small but they increase, then attention to the disadvantaged group decreases more and attention discrimination increases, while at large costs a further increase in the costs decreases the attention discrimination.

While we do not test the following implications experimentally, the model suggests an important role of timing when the group attribute is revealed during the decision-making proces, an insight which is potentially interesting for policy. Postponing the revelation helps the disadvantaged group by affecting the level of attention the DM pays to the applicant. This effect is not present in the standard model of statistical discrimination, because there the DM receives signals of exogenously-

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<sup>9</sup> Notice that these findings hold for whole groups only. For instance, an individual of a very high quality in a “lemon-dropping” market might be better off when associated with a group of lower mean since then the DM chooses to pay more attention and can be more likely to spot the individual’s high quality.

given precision and forms his posterior knowledge independent of the signals' succession, while in our model the first signal affects the choice of the precision of the following signal.

COROLLARY 1 (timing of ethnic group revelation)

*In both “cherry-picking” and “lemon-dropping” markets, and in “middle” markets if  $|q_G - R| > |q_P - R|$ , the probability that an applicant from group  $G$  is accepted is (weakly) lower if he is known to be from  $G$  prior to when the DM chooses the precision of signal  $y$  (and before he receives  $y$ ) rather than when he is first considered to be from  $P$  and his membership in  $G$  is revealed only before the final selection decision.*

Proof: Supplementary material.

Our model also provides implications for cases when the variance of beliefs or the costs of information differ across groups. A higher variance of beliefs increases attention and higher costs decrease it. The distinction from Proposition 1, where the groups differ in quality means, is that the ranking of attention levels across groups is then independent of the market type, i.e. of the position of the threshold. Group  $G$  is either always paid less attention than  $P$  or always more.

### **III. FIELD EXPERIMENT IN THE RENTAL HOUSING MARKET**

In the first experiment, we study discrimination against Roma and Asian minorities in the rental housing market in the Czech Republic, a market with a low level of selectivity. The Roma population constitutes the largest ethnic minority in the European Union (estimated at 6 million people, 1.2%) as well as in the Czech Republic (1.5-3%). Intolerance and social exclusion of Roma is considered one of the most pressing social and human rights issues in the European Union (European Commission 2010). The unemployment rate of Roma in the Czech Republic was estimated at 38% compared to 9.4% overall unemployment rate in 2012. East Asians

(mostly Vietnamese but also Chinese or Japanese) are the second-largest ethnic minority group in the Czech Republic (0.6%) and migrants from East Asia form large minority groups in many European countries. In the Czech Republic they are mostly self-employed in trade and sales businesses and lack formal employment. While on average 23% of people aged 19-30 years attended university in 2012 in the Czech Republic, among the Vietnamese minority it was only 6%. An opinion poll revealed that 86% and 61% of Czechs would not feel comfortable or would find it unacceptable to have Roma and Vietnamese as neighbors, respectively.<sup>10</sup>

### *III.A. Experimental Design*

The experiment was based on sending emails expressing interest in arranging an apartment viewing. To evoke ethnic minority status we designed three fictitious applicants: representatives of the Asian and Roma ethnic minorities and a control identity of the White majority group. The only real attributes of these identities were a name, an email address and a personal website.<sup>11</sup> We selected the names based on name frequency data: Jiří Hájek (White majority-sounding name), Phan Quyet Nguyen (Asian-sounding name) and Gejza Horváth (Roma-sounding name).<sup>12</sup> For the

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<sup>10</sup> For more details about the socio-economic status of Roma in Central and Eastern European countries see Barany (2002). FRA and UNDP (2012) describe documented inequalities in education, employment, health and housing outcomes between Roma and majority populations in the Czech Republic and other EU countries. Spaan, Hillmann and van Naerssen (2005) provide a detailed description of integration of immigrants from East Asia in Europe.

<sup>11</sup> There is a difficult trade-off involved in organizing a natural field experiment on discrimination. While informed consent is clearly desirable, it is obvious that one cannot measure discrimination with the consent of participants (List and Rasul 2011). Therefore, field experiments on discrimination are considered among the prime candidates for the relaxation of informed consent (Pager 2007, Riach and Rich 2002), and this has been the practice of all existing audit and correspondence field experiments on discrimination. Our research has been approved by the management of the Institute of Economic Studies, Charles University in Prague. We also did our best to minimize the landlords' costs. We sent only one application to each landlord and we quickly declined invitations for an apartment viewing, within two days at most. The information acquisition was designed such that it took little effort and time. A similar practice was followed in our companion experiments in the labor markets.

<sup>12</sup> Jiří is the most frequent Czech first name and Hájek is among the top 20 most frequent surnames in the Czech Republic. Nguyen and Horváth are the most frequent surnames for the Asian and Roma minorities, respectively. In order to test how the names selected for the experiment compare with other names associated with the same ethnicity, we conducted a survey on perceptions of socio-economic status (education level and quality of housing). For each ethnicity, we included the name used in the experiment and three other names. Within each ethnic group, all majority-sounding names and all Asian-sounding names are perceived very similarly (Table S1 in the Supplementary material). The Roma-sounding name used in our experiment is perceived similarly as one of the three names and as signaling a somewhat lower socio-economic status compared to two remaining Roma names.

sake of brevity, we denote applicants with a White majority-sounding name as “White applicants” or as “majority applicants”, applicants with ethnic minority-sounding names (both Asian and Roma) as “minority applicants”, and applicants with Asian-sounding and Roma-sounding names as “Asian applicants” and “Roma applicants”, respectively. Note that technically the results of our experiments describe the effects of the ethnic sounding-ness of the names rather than the effects of ethnicity itself.

To verify that landlords associated the selected names with respective ethnic groups, we conducted a pre-survey on a sample of 50 respondents. All respondents associated the name Jiří Hájek with the Czech nationality and the name Phan Quyet Nguyen with one of the Asian nationalities (92% associated it with Vietnamese nationality), and the name Gejza Horváth was thought to be a Roma name in 82% of cases, indicating a strong link between names and ethnic status. Next, we sent each variant of the email message to 40 individuals with email accounts from different providers. In all cases the emails were delivered successfully, affirming that spam filters do not affect our estimates.

In application emails, we manipulated access to information about applicants. In the No Information Treatment, the email contains a greeting and the applicant’s interest in renting an apartment, but does not provide any information about the characteristics of the applicant, other than his minority/majority-sounding name. Next, in the Monitored Information Treatment, the email uses the same sentence to express interest in viewing an apartment. The only difference is that it includes a hyperlink to a personal website located in the applicant’s electronic signature, which gives landlords an opportunity to acquire more information about an applicant. The link has a hidden unique ID number assigned to each landlord, which allows us to distinguish landlords who decide to acquire information about the applicant.

The website contains information about individual characteristics that are likely to affect the attractiveness of a prospective tenant: education, employment status, age, marital status and smoking habits. All applicants reported to be 30 years old, single, non-smokers, having a high school or college degree and working in trade with a steady income. We avoided syntax or spelling mistakes.

Software similar to Mouselab monitors landlords' information acquisition on the website. Five different boxes are located in the main section of the website, each with a heading representing a type of information that is hidden "behind" the box such as education, job, etc. A snapshot is displayed in Figure S1 in the Supplementary material. Since only one box can be opened by a computer mouse at one point in time, the software allows us to identify whether a landlord decides to acquire information on an applicant's website, and how many and which pieces of information receive attention. These monitoring features provide direct insight into the process of information acquisition. In addition to the boxes with personal information, the website also contains tags for a personal blog, pictures and contact information (when accessed, an "under construction" note pops up, to reduce landlord's costs by limiting the time spent on the website). The design of the website is based on a professionally created template, which is freely available on the Internet.

Still, to some landlords the website may appear unusual and this may affect their callback. Nevertheless, it should be noted that the content and the design of the website cannot affect a decision whether or not to open it, since the decision happens when the landlords sees only the link.

### *III.B. Sample Selection and Data*

The experiment was implemented between December 2009 and August 2010 in the Czech Republic, mostly in Prague. Over that period, we monitored four (out of ten) major websites that provide rental advertisements.<sup>13</sup> Placing an ad on these websites requires a small fee, while responding to an advertisement is free. We chose to apply only for small homogenous apartments of up to two rooms with a separate kitchen that look suitable for a single tenant without a family. We excluded offers mediated by real estate agents and also offers where landlords did not make their email publicly available and relied on a telephone or an online form (66%), in order to be able to monitor information acquisition. Overall, we responded to 1800 rental ads and randomly assigned an applicant name and provided information. We recorded the

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<sup>13</sup> In 2012, 65% of households had Internet access at home (Czech Statistical Office 2013).



gender of the landlord, implied by the name, and the characteristics of apartments commonly published as a part of the advertisement such as rental price, the size of the apartment and whether it is furnished. These characteristics vary little across experimental treatments, indicating that randomization was successful (Table S2 in the Supplementary material).

To measure attention in the Monitored Information Treatment, we record whether a landlord visits an applicant’s personal website and how many and which boxes with information he uncovers. To measure responses to the applicant, we distinguish between a positive response, indicating either a direct invitation to an apartment viewing or an interest in further contact, and a negative response, capturing the rejection of an applicant or the absence of response.<sup>14</sup> Note that with the correspondence experimental approach a researcher does not measure the ultimate outcomes, i.e. whether an applicant rents the apartment and for what price. Nevertheless, we believe that it is plausible that the gaps in the share of positive responses across ethnic groups translate into gaps in final decisions about actual rental.

### *III.C. Results*

#### *III.C.1. Do Landlords Discriminate Against Minorities?*

We start the analysis by looking at whether ethnic minorities are discriminated against when no information about the applicant other than his name is available to a landlord (No Information Treatment). In this treatment, the invitation rates reflect the tastes and prior beliefs about the expected characteristics of each group. We find that majority applicants are invited for an apartment viewing in 78% of cases, while minority applicants receive invitations in only 41% of cases (Panel A of Table I). The gap that arises solely due to name manipulation is large in magnitude (37 percentage

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<sup>14</sup> As a robustness check, we also estimated the effect of minority-signaling names on callback (Table S3 in the Supplementary material), which distinguishes applications that result in contact, regardless of whether it is a positive or negative response. Overall, we find qualitatively similar impact of name on the callback rate as on the invitation rate.

points, or 90%) and statistically significant at the 1% level. Put differently, minority applicants have to respond to almost twice as many advertisements to receive the same number of invitations as majority applicants.

Next, we distinguish between applicants with Asian- and Roma-sounding names. The invitation rates are very similar: 43% for the Roma minority and 39% for the Asian minority applicants. The difference in invitation rate between the two minority groups is not statistically distinguishable (Column 8, Panel A of Table I), while the gap between the majority and each of the two minority groups is large and similar in magnitude (Columns 5 and 7 of Table I, Column 2 of Table II).

**Observation 1:** Applicants with minority-sounding names are discriminated against. If no information about applicants is available, applicants with a majority-sounding name are 90% more likely to be invited for an apartment viewing compared to applicants with a minority-sounding name.

**Table I:** Czech Rental Housing Market—Invitation Rates and Information Acquisition by Ethnicity, Comparison of Means

	White majority name (W) (1)	Pooled Asian and Roma minority name (E) (2)	p.p. difference: W-E, (p-value) (3)	Asian minority name (A) (4)	p.p. difference: W-A, (p-value) (5)	Roma minority name (R) (6)	p.p. difference: W-R, (p- value) (7)	p.p. difference: R-A, (p-value) (8)
<b>Panel A: Invitation for an apartment viewing</b>								
No Information Treatment (n=451)	0.78	0.41	<b>37 (0.00)</b>	0.39	<b>39 (0.00)</b>	0.43	<b>36 (0.00)</b>	3 (0.57)
Monitored Information Treatment (n=762)	0.72	0.49	<b>23 (0.00)</b>	0.49	<b>23 (0.00)</b>	0.49	<b>23 (0.00)</b>	0 (0.92)
Monitored Information Treatment <sup>a</sup> (n=293)	0.84	0.66	<b>18 (0.00)</b>	0.71	<b>13 (0.00)</b>	0.62	<b>21 (0.00)</b>	-9 (0.20)
<b>Panel B: Information acquisition in the Monitored Information Treatment</b>								
Opening applicant's personal website	0.33	0.41	<b>-8 (0.03)</b>	0.38	-5 (0.24)	0.44	<b>-11 (0.01)</b>	6 (0.15)
Number of pieces of information acquired	1.29	1.75	<b>-0.46 (0.01)</b>	1.61	<b>-0.32 (0.09)</b>	1.88	<b>-0.59 (0.00)</b>	0.27
Number of pieces of information acquired <sup>a</sup>	3.91	4.24	<b>-0.33 (0.06)</b>	4.23	-0.32 (0.15)	4.25	<b>-0.34 (0.09)</b>	0.02 (0.90)

*Notes:* Means. Standard deviations in parentheses. Panel A reports how name affects invitation for an apartment viewing and Panel B how it affects information acquisition in the Monitored Information Treatment. Columns 3, 5, 7 and 8 report differences in percentage points; in the parentheses we report p-value for a t-test testing the null hypothesis that the difference is zero. The differences in the number of pieces of information acquired on the website are reported in absolute terms, not in percentage points.<sup>a</sup>The numbers are reported for the sub-sample of landlords who opened an applicant's website.

Since in this treatment landlords do not receive any specific characteristics of applicants and make inferences based on the applicant's name (and the short text) only, the decision whether to invite should closely reflect whether the expected quality of an applicant is greater than the threshold quality. Since most majority applicants are invited (78%), the mean of the prior belief about this group seems to be far above the threshold level of quality necessary for invitation. On the other hand, the

lower invitation rate observed for minority applicants, or more precisely an invitation rate closer to 50%, indicates that the mean prior beliefs about the quality of this group is closer to the quality threshold. Thus, acquiring more information about minority applicants should be more valuable, compared to acquiring information about majority applicants.

### *III.C.2. Do Landlords Choose Different Levels of Attention to Information Based on the Ethnicity of an Applicant?*

In the Monitored Information Treatment, we find that only less than half of the landlords open the applicant's website even though the cost of acquiring information is very small—literally one click on the hyperlink—suggesting that attention is indeed a scarce resource. Importantly, the applicant's name matters for attention allocation (Panel B of Table I). While 41% of landlords opened the website of minority applicants, 33% did so for majority applicants and the difference of 8 percentage points (24 percent) is statistically significant at 5% level.

Among landlords who opened an applicant's website, we still observe more effort to acquire information about minority applicants. Landlords open a higher number of boxes with information when the applicants have minority names compared to majority names. This is because landlords are significantly more likely to open the box with information about the occupation of minority applicants compared to majority applicants. The effects on opening boxes with other characteristics go in the same direction but are insignificant statistically.

Taken together, the likelihood of acquiring information about, for example, education level is 36% for minority applicants and 27% for majority applicants. Thus, the difference due to name manipulation is 33% (or 9 percentage points). A similar picture arises for other individual characteristics: the likelihood of paying attention to those is 30-46% greater for minority applicants compared to majority applicants. When summing the number of applicant characteristics to which a landlord pays attention (the maximum is five), we find that landlords learn about 1.75 characteristics of a minority applicant and 1.29 for a majority applicant.

Distinguishing between the two minority groups reveals that, compared to the majority applicant, landlords acquire more information about both Roma and Asian applicants (Columns 5 and 7). We also observe that the amount of acquired information is somewhat (although insignificantly) greater for Roma applicants relative to Asian applicants (Column 8). This is interesting given that the landlords appeared to hesitate most on whether to invite Roma applicants, since the invitation rate of this minority was closest to the 50% invitation rate.

Panel B of Table II reports the results in a regression framework, where we control for the landlord's gender and the characteristics of the apartment described in an advertisement (price, size, furnishings). We arrive at the same conclusion: The likelihood of a landlord visiting an applicant's website and the number of pieces of information acquired is higher for minority applicants compared to majority applicants.

**Observation 2:** Landlords pay more attention to available information about applicants with a minority-sounding name relative to applicants with a majority-sounding name.

**Table II:** Czech Rental Housing Market—Invitation Rates and Information Acquisition by Ethnicity, Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Panel A: Landlord's response</b>								
<b>Dependent variable:</b>	<b>Invitation for an apartment viewing</b>							
Sample:	No Information Treatment		Monitored Information Treatment		W majority name	E minority name		
Ethnic minority name	-0.39*** (0.04)		-0.23*** (0.04)					
Asian minority name		-0.41*** (0.05)		-0.24*** (0.04)				
Roma minority name		-0.39*** (0.05)		-0.24*** (0.04)				
Monitored Information Treatment					-0.06 (0.05)	0.08** (0.04)		
Additional text in the email - with high school					-0.00 (0.06)	0.08* (0.05)		
Additional text in the email - with college					0.01 (0.06)	0.15*** (0.05)		
Observations	451	451	762	762	599	1,194		

**Panel B: Information acquisition**

<b>Dependent variable:</b>	<b>Opening applicant's personal website</b>	<b>Number of pieces of information acquired</b>	<b>Number of pieces of information acquired about education and occupation</b>	<b>Number of pieces of information acquired about personal characteristics</b>
Sample:	Monitored Information observations	Treatment - all observations	Monitored Information sample of landlords who opened applicant's website	Treatment - sub-sample of landlords who opened applicant's website
Ethnic minority name	0.08** (0.04)	0.46*** (0.16)	0.18** (0.09)	0.12 (0.13)
Asian minority name	0.05 (0.04)	0.31 (0.19)	0.17* (0.10)	0.07 (0.14)
Roma minority name	0.11*** (0.04)	0.60*** (0.19)	0.18* (0.09)	0.15 (0.14)
Observations	762	762	293	293

*Notes:* Probit, marginal effects (dF/dx) in all Columns of Panel A, and Columns 1, 2, 5-8 of Panel B. OLS in Columns 3-4 of Panel B. Robust standard errors in parentheses. \*\*\* denotes significance at the 1% level, \*\* at the 5% level and \* at the 10% level. In Panel B, Columns 3-4, the dependent variable is number of pieces of information a landlord viewed on an applicant's personal website—minimum is 0 and maximum is 5. In Columns 5-6 it is the number of pieces of information about education and occupation he/she uncovered—minimum is 0 and maximum is 2. In Columns 7-8 it is the number of pieces of information about personal characteristics (age, smoking habits, marital status) he/she uncovered — minimum is 0 and maximum is 3. In Columns 1-4 of Panel A and all columns of Panel B the omitted variable is a White majority name. In Columns 5-6 of Panel A the omitted variable is a dummy for No Information Treatment. In all columns of both panels, we control for a dummy variable indicating a landlord being a female, a dummy variable indicating an unknown gender of a landlord (the mean of this variable in the whole sample as well as in the Information with Monitoring Treatment is 0.02), size of an apartment, price of an apartment rental, and a dummy variable indicating a furnished apartment.

### III.C.3. Responsiveness to Available Information

Does the greater inspection of the personal website of minority applicants compared to majority applicants matter? If it does, then we should observe a greater responsiveness in the invitation rate to manipulations in available information about minority applicants compared to information about the majority applicants, echoing

the observed differences in attention. To test this we estimate the responsiveness to three manipulations in the available information: (1) adding a sentence to the email message signaling attractive characteristics of the applicant asking for an apartment viewing (“I am a thirty-year-old man, I am single, I have a college [a high school] degree, and I do not smoke. I have a steady job (with a regular paycheck) at a company.”), (2) varying the education level between high-school degree and college degree in the added sentence, and (3) having access to an applicant’s personal website.

We find that the invitation rate responds to information provided by applicants with minority names, a pattern which is consistent for all three manipulations of available information. Column 6 in Panel A of Table II shows that, relative to the No Information Treatment, the invitation rate increases by 8 percentage points for minority applicants who add the sentence reporting high school education. The increase is larger, 15 percentage points, for minority applicants who add a sentence and report having a college degree. The pure effect of reporting a college degree compared to a high school degree is 8 percentage points, which is marginally significant statistically. Last, giving access to a personal website increases the invitation rate by 8 percentage points.<sup>15</sup>

In contrast, there is little response in the invitation rate when the same manipulations of available information are performed by the applicant with the majority name (Column 5). The invitation rate remains at the same level, 78%, independent of whether the applicant provides no information, includes a sentence about his characteristics, and also does not respond to changes in his education level. Only having access to an applicant’s personal website causes a moderate but not statistically significant response: the invitation rate diminishes by 6 percentage points.

**Observation 3:** The landlords’ decision whether to invite an applicant is responsive to manipulations of the available information about applicants with a minority-

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<sup>15</sup> Landlords are responsive to changes in available information about both minority groups (Table S4 in the Supplementary material).

sounding name, while the decision is not (or only little) affected by the same changes in the available information about applicants with a majority-sounding name.

The observed greater inspection of personal websites of minority applicants in the housing market could be, in principle, due to pure curiosity to read about dissimilar individuals,<sup>16</sup> not motivated by an assessment of quality for selection decisions. Additional results do not provide support for this interpretation: (1) the correlation between opening a website and inviting is similar or greater for minority applicants compared to majority applicants (Table S5 in the Supplementary material), (2) the observed differences in attention across groups mimic observed differences in responsiveness to manipulations of available information, and (3) the effect of a minority name is largest on uncovering occupation information (compared to age, education, smoking habits, and marital status), arguably a very relevant characteristic for assessing the ability to pay rent and thus for a selection decision.

To summarize the main results in the rental housing market, we find that a name affects both the choices of whether to invite an applicant for an apartment viewing as well as the attention paid to information prior to this decision. Applicants with minority-sounding names are more thoroughly inspected and less likely to be invited for an apartment viewing. Differences in the observed level of inspection across the groups mimic greater responsiveness of the invitation rate to the manipulation of available information about the quality of applicants with minority-sounding names.

#### **IV. FIELD EXPERIMENT IN THE LABOR MARKET – CZECH REPUBLIC**

The second experiment shifts the exploration of discrimination to the labor market. Here, we aim to study discrimination during a selection process in which decision makers pick only a few winners out of a large pool of applications, in contrast to the rental housing market.

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<sup>16</sup> 93% of landlords in our sample have a White majority-sounding name.

#### *IV.A. Experimental Design*

We use the same names as in the rental housing market experiment to evoke Asian, Roma and White majority ethnic status. The experiment was implemented between August and October 2012 in the Czech Republic. Over that period we monitored the major online job site ([www.jobs.cz](http://www.jobs.cz)) and responded to online job advertisements. We implement the treatment with the monitoring of information acquisition, and send an application via email. The email contains a greeting, the applicant's interest in the job opening, his name and a hyperlink to his professional resume on a website. The exact wording is in the Supplementary material.

We created a conventional resume, following real-life resumes for the types of jobs we study. Each has six parts: education, experience, skills, hobbies, references and contacts. Applicants are 23-year-old males, with a high school or a college degree, and have prior work experience as administrative workers. They report a good knowledge of English, PC skills and a driver's license. They also list their hobbies and provide two reference contacts.

When employers open the website, they can see a standard version of the resume. Further, they can click on "learn more" buttons placed below each resume category label (contact, education, experience, skills and hobbies). For example, when the website is accessed it reveals basic information about previous employment experience: the name of the firm, the position held and the time period. By clicking on the "learn more" button below the "Experience" label, the website reveals the applicant's responsibilities (e.g., document management, administrative support of consultants, work with PC). Thus, in addition to monitoring whether an employer opens the resume, we measure whether an employer decides to acquire more and which type of information. An example of the shorter as well as the expanded form of the resume is in Figure S2 in the Supplementary material.

#### *IV.B. Sample Selection and Data*

We focused on job openings in sales, customer service, and administrative work. We selected these job categories because they have a sufficient flow of new openings and



are similar enough not to require subtle adjustments of particular skills in resumes. In addition, we aimed to minimize the costs for the employers of reviewing the resumes and thus we selected job categories that involve less intensive inspection of applicants compared to higher-skill jobs. We also sent only one email to each employer and politely declined all invitations for job interviews within two days.

We target the population of employers who use the Internet to advertise job openings. To be able to monitor the opening of an applicant's resume, we had to exclude ads in which employers did not make their email publicly available and required applicants to call or use an online form (59%). Overall, we responded to 274 job openings and to each of them we randomly assigned the name of an applicant. We record the type of job, the job requirements and the time when the application was sent. The means of the observable characteristics of job openings are similar across the three groups of applicants (Table S6 in the Supplementary material), with the exception of a somewhat higher likelihood of majority applicants applying for openings that required previous job experience, compared to minority applicants ( $p$ -value=0.13) and the lower likelihood of majority applicants applying during the holiday period ( $p$ -value=0.12). In the analysis, we rely on a comparison of means across treatment conditions, as well as a regression analysis in which we control for observable characteristics.

We study how name manipulation affects two types of choices: attention to a resume and the selection decision. First, we measure whether an employer opened an applicant's resume by clicking on the hyperlink to a resume website. Further, we identify which additional information about an applicant an employer uncovered by clicking on the "learn more" buttons. As was the case in the first experiment, we do not measure the ultimate outcome of a selection process (an actual employment offer and wage). The outcome measure is whether the employer emailed or called the applicant back with a decision ("callback") and whether the employer decided to

invite the applicant for an interview (“invitation”), a more precise outcome of the initial stage of selection process than callback.<sup>17</sup>

#### *IV.C. Results*

##### *IV.C.1. Are Ethnic Minorities Less Likely to be Invited for a Job Interview?*

Panel A of Table III documents a large amount of discrimination against minority applicants. The callback rate for majority applicants is 43% and only 20% for minority applicants, making a difference of more than 100%, which is highly significant statistically ( $p < 0.01$ ). A similar picture arises when we turn to the invitation rate. While majority applicants are invited in 14% of cases, minority applicants receive an invitation only in 6.3% of cases. The gap is statistically significant ( $p\text{-value} = 0.03$ ) and is large in magnitude (133%).

While we observe the almost identical treatment of applicants with Roma- and Asian-sounding names in the rental housing market, we find some differences in the labor market. Both minority groups are less likely to be invited for a job interview compared to the majority group. The gap, however, is larger and more significant statistically for the Asian minority applicant (5.1% invitation rate,  $p\text{-value} = 0.03$ ) than the gap for the Roma minority applicant (7.8% invitation rate,  $p\text{-value} = 0.18$ ). Put differently, Asian applicants need to send 20 applications to receive one invitation, Roma applicants 12.5 and majority applicants 7.5. Columns 1-2 of Table IV demonstrate the evidence in a regression framework. Controlling for observable job characteristics—required high school education, required previous experience, the type of job, and whether the application was sent during the summer holidays—does not affect the size of the observed gaps in the invitation rates and somewhat increases

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<sup>17</sup> Since the application was sent via email, the most common response from employers was also via email: 25.9% of employers emailed back, 9.1% invited the applicant for an interview and 16.8% declined the application. Employers could also call the applicant’s cell phone number reported in the resume. However, only a few employers called back (5.8%). We recorded “missed calls” on each cell phone and then called back to determine the particular employer. Since most of the employers who made a phone call also responded via email and one employer sent a text message with an invitation; in only six cases we cannot directly identify whether the employer who called back meant to invite the applicant or not. In the main estimations we assume they did not, given the large fraction of declines in the email responses and the fact that these employers did not get in touch with the applicant via email.

precision. We also find that employers who decide to read a resume are more likely to invite the applicant and those who request previous job experience are less likely to invite the applicant (available upon request).<sup>18</sup>

**Table III:** Czech Labor Market—Invitation Rates and Information Acquisition by Ethnicity, Comparison of Means

	White majority name (W)	Pooled Asian and Roma minority name (E)	p.p. difference: W-E, (p-value)	Asian minority name (A)	p.p. difference: W-A, (p-value)	Roma minority name (R)	p.p. difference: W-R, (p-value)	p.p. difference: R-A, (p- value)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Panel A: Employer's response</b>								
Callback	0.43	0.20	<b>23 (0.00)</b>	0.17	<b>26 (0.00)</b>	0.25	<b>18 (0.01)</b>	8 (0.22)
Invitation for a job interview	0.14	0.06	<b>8 (0.03)</b>	0.05	<b>9 (0.03)</b>	0.08	6 (0.18)	3 (0.46)
Invitation for a job interview <sup>a</sup>	0.19	0.09	<b>10 (0.06)</b>	0.09	10 (0.12)	0.10	9 (0.16)	1 (0.83)
<b>Panel B: Information acquisition</b>								
Opening applicant's resume	0.63	0.56	7 (0.22)	0.47	<b>16 (0.03)</b>	0.66	-3 (0.69)	<b>19 (0.01)</b>
Acquiring more information about qualification <sup>a</sup>	0.16	0.10	6 (0.27)	0.06	10 (0.12)	0.14	2 (0.73)	8 (0.24)
Acquiring more information about other characteristics <sup>a</sup>	0.18	0.18	0 (0.92)	0.19	-1 (0.85)	0.18	0 (0.99)	1 (0.85)

*Notes:* Means. Standard deviations in parentheses. Panel A reports how name affects callback and invitation for a job interview and Panel B shows how it affects information acquisition. Columns 3, 5, 7 and 8 report differences in percentage points; in the parentheses we report p-value for a t-test testing the null hypothesis that the difference is zero. Acquiring more information about qualifications is a dummy variable indicating whether an employer clicked on "learn more" buttons on a resume to acquire more information about education, experience, and skills. Acquiring more information about other characteristics is a dummy variable indicating whether she/he acquired more information about hobbies and contact information. <sup>a</sup>The numbers are reported for the sub-sample of employers who opened the applicant's resume.

**Observation 4:** Applicants with minority-sounding names are discriminated against in the labor market. An applicant with a majority-sounding name is 180% more likely to be invited for a job interview compared to an applicant with an Asian-sounding name, and 75% more likely compared to an applicant with a Roma-sounding name.

The invitation rate (on average 9.1%) in the labor market is much lower than 50%, despite the fact that the resume signals the relatively high quality of applicants for the selected job types. If we were to link this observation to theory, it would imply that mean prior beliefs about the quality of all groups are below the threshold necessary for an interview invitation and that the labor market is the “cherry-picking”

<sup>18</sup> It is noteworthy that discrimination is not restricted to jobs where language skills and interactions with customers are central (sales and services), and thus employers could presumably discriminate due to a belief about language use or due to the expected taste-based discrimination of their customers (Table S7 in the Supplementary material).

type of market.<sup>19</sup> Resumes of applicants with minority names, and with Asian names in particular, are thus predicted to receive less attention compared to resumes provided by majority applicants.

**Table IV:** Czech Labor Market—Invitation Rate and Information Acquisition by Ethnicity, Regression Analysis

Dependent variable	Invitation for a job interview		Opening applicant's resume		Acquiring more information about qualification		Acquiring more information about other characteristics	
	All		All		Employers who open applicant's resume			
Sample:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ethnic minority name	-0.09***		-0.08		-0.07		-0.01	
	(0.04)		(0.06)		(0.06)		(0.064)	
Asian minority name		-0.08**		-0.16**		-0.10*		-0.00
		(0.03)		(0.07)		(0.05)		(0.08)
Roma minority name		-0.06*		0.03		-0.03		-0.02
		(0.03)		(0.08)		(0.06)		(0.07)
Observations	274	274	274	274	160	160	160	160

*Notes:* Probit, marginal effects (dF/dx), robust standard errors in parentheses. \*\*\* denotes significance at the 1% level, \*\* at the 5% level and \* at the 10% level. In Columns 5-6, the dependent variable is a dummy variable indicating whether an employer clicked on "learn more" buttons on a resume to acquire more information about education, experience, and skills; in Columns 7-8 it indicates whether she/he acquired more information about hobbies and contact information. In all columns the omitted variable is a White majority name and we control for dummy variables indicating required high school education, required previous experience, applications being sent during a holiday period (August), and applications submitted in the sales and services sector.

#### *IV.C.2. Do Employers Choose Different Levels of Attention to Information Based on the Ethnicity of an Applicant?*

We start by looking at the likelihood of opening a resume. Of employers, 58% open the resume.<sup>20</sup> Name again matters. We find that while 63.3% of employers visit the webpage with the resume of majority applicants, only 47.5% of employers do so when they receive an application with the Asian-minority name. The difference is large in magnitude (34%) and significant statistically (Panel B of Table III and Column 4 of Table IV) and it demonstrates that ethnicity signaled by name represents a barrier even at the very start of a selection process, before any information about an

<sup>19</sup> Low invitation rates seem to be a ubiquitous feature of labor markets. The invitation rates do not get anywhere close to 50% in any segment of the market, which does not allow us to test the theoretical prediction about the "switch" in relative attention between minority and majority groups within one type of market (in contrast to testing it across two different markets, as we do in this paper).

<sup>20</sup> The fact that 37% of employers did not open the resume of majority applicants indicates, for instance, that some of the openings were filled before the advertisement we responded to was withdrawn from the online job site.

applicant is acquired. Moreover, in some firms it is common to delegate the printing of all received applications to an assistant, and printed resumes are then screened and evaluated by a different person. In such cases our experimental design fails to measure differences in attention, biasing down the estimated effect of a name on the likelihood of opening a resume. Regarding Roma-minority applicants, i.e. the group with the invitation rate between the majority and the Asian-minority applicants, we find no discrimination in attention: the likelihood of opening the resume is the same as for the majority applicant and higher compared to the Asian-minority applicant (Column 4 of Table IV).

Further, we study whether employers differentiate attention after opening the resume. Overall, we find relatively little interest to acquire further information; only 23% of employers clicked on at least one out of five “learn more” buttons. Despite relatively little variation, the data reveal that employers paid less attention to the qualifications of Asian-minority applicants. Specifically, when considering majority applicants, 16% of employers further inspected at least one out of three categories that seem relevant for assessing qualifications (experience, education and skills), while only 6% made that effort when considering Asian-minority applicants (Panel B of Table III). We find no differences in acquiring information about contacts and hobbies.

In sum, the Asian minority, i.e. the group with the lowest invitation rate, receives the least attention, which is in line with the predictions of our model of attention discrimination. Since the invitation rate of the Roma-minority applicant is lower than the invitation rate of the majority applicant and higher than the invitation rate of the Asian-minority applicant, the model predicts that the amount of acquired information about the Roma applicant should also be somewhere between the Asian applicant and the White applicant. Nevertheless, we do not observe any differences in attention compared to the majority applicant.

**Observation 5:** Employers are 34% more likely to read a resume provided by applicants with majority-sounding names relative to applicants with Asian-sounding names. Conditional on opening a resume, employers more closely inspect the

qualifications of applicants with a majority-sounding name relative to applicants with an Asian-sounding name. There is little difference in the likelihood of opening a resume as well as in the depth of resume inspection between applicants with majority- and Roma-sounding names.

Although the selected names used in the experiments strongly signal ethnicity, they may also signal some other characteristics, social background in particular. In order to assess whether our findings can be explained by discrimination against individuals with low socio-economic status (SES), we turn to the survey on perceptions, which we conducted among 92 respondents. For each name used in the experiment, we measure associations with level of schooling and quality of housing. We find that the majority-sounding name is perceived as having the highest SES, the Roma-sounding name the lowest SES, and that the Asian-sounding name is in the middle (Table S8 in the Supplementary material). If the results in the experiment were fully driven by SES, we would expect the Roma minority to be the most discriminated against, and thus this analysis does not provide strong support for the SES interpretation of the name effects. Nevertheless, other components of SES not measured in the survey or other characteristics besides ethnicity correlated with names (such as language accent) may still drive the observed discrimination. Importantly, in terms of testing whether gaps in attention exist and whether they follow theoretical predictions for an attention-optimizing agent, it should not matter what is the particular source of difference in beliefs.

## **V. LABOR MARKET—GERMANY**

The third field experiment tests two further considerations: (i) generalizability of attention discrimination against negatively stereotyped ethnic groups to a different country, Germany, and (ii) generalizability to other types of signals of applicant's quality beyond ethnicity, such as being unemployed.

### *V.A. Experimental Design*

We study discrimination against the Turkish minority in the German labor market. Individuals with a Turkish background represent the largest minority in the country

(2.9% of population). Migrants from Turkey came to Germany predominantly in the 1960s and their children and grandchildren, raised in Germany, now represent a significant share of Germany's labor force. Importantly, Kaas and Manger (2012) found evidence of discrimination against the Turkish minority by employers. In their recent field experiment a White majority-sounding name increased the likelihood of a callback by 14% compared to a Turkish sounding name. We build on these results by focusing on the effects of a minority name on information acquisition prior to a selection decision whether to invite an applicant for a job interview.

We use the same names as Kaas and Manger (2012) to signal White majority and Turkish ethnicity.<sup>21</sup> The experiment was carried out between August and September 2013. We used major online job advertisement sites in Germany and sent email applications to 745 online job postings in sectors such as information and communication, administration, health and education, manufacturing and construction. We responded to all job ads that were posted directly by the company and included an email contact in the text of the posting (66% of all ads).

The email contains a greeting, the applicant's interest in the job opening, his name, and a hyperlink to his professional resume on a website, as in the experiment in the Czech Republic. In addition to varying names, we have implemented three treatment conditions by randomly varying the text of the application email. In the baseline condition (50% of responses) the text was the same as in the Czech Republic. Next, we have implemented two conditions (25% of responses each), in which the text of application email contains a negative signal about an applicant's quality. Specifically, the email includes the following sentence: "I have been searching for a job for two months [a year and a half]." The negative signals come from revealing the applicant's POTENTIAL unemployment to the employer, as well as carelessness demonstrated in releasing this information in the introductory email. Otherwise, the text is identical as in the baseline condition. Observable characteristics of the job

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<sup>21</sup> The first names and surnames of White majority applicants—Denis Langer and Tobias Hartmann—belong to the 30 most common names in Germany. The names of the ethnic minority applicants—Fatih Yildiz and Serkan Sezer—are very common for male descendants of Turkish immigrants.

openings vary little across experimental conditions (Table S9 in the Supplementary material).

As outcomes of interest, we again focus on measures of information acquisition by the employers. We have altered the design of the experiment to aim at more detailed measures of effort to acquire a resume. The provision of a hyperlink allows us to distinguish whether an employer decides to open the resume. In this experiment clicking on the link does not, however, reveal an applicant's resume but instead a browser displays a message indicating a temporary error on the server.<sup>22</sup> We measure whether an employer clicked on the link, the number of times the employer attempted to re-open the resume and the likelihood that the employer sent an email requesting the resume to be re-sent, an action that requires nontrivial effort. Since the gap in terms of callback has already been established in previous work (Kaas and Manger 2012), we have not proceeded by responding back with a resume to minimize the costs on the part of employers, and we focus purely on information acquisition.

#### *IV.B. Results*

We find that a minority name reduces employer's effort to acquire information about an applicant compared to a majority applicant. This effect holds for all three measures of information acquisition: likelihood of opening an applicant's resume (Panel A of Table V and Column 1 of Table VI), number of attempts to open an applicant's resume (Column 3) and a likelihood of writing back requesting an applicant to re-send the resume (Column 5).

**Observation 6:** Applications with Turkish minority names receive lower attention in all three measures than applications with majority names in the German labor market.

**Table V:** German Labor Market—Information Acquisition by Ethnicity, Comparison of Means

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<sup>22</sup> The message is "Database connection error (2): Could not connect to MySQL Server!" Such a message commonly appears when announcing a failure to connect to the database server due technical problems on the provider's side and thus should not indicate a mistake on the part of the applicant. Nevertheless, we cannot rule out that failure to open the resume was *perceived* by some employers as a mistake of applicant and thus a negative signal about his quality.



	(1)	(2)	(3)	(4)	(5)
<b>Panel A: Effect of name on information acquisition</b>					
	White majority name (W) (n=366)	Ethnic minority name (E) (n=379)	difference: W-E (p-value)		
Opening applicant's resume	0.81	0.75	<b>0.06 (0.06)</b>		
Number of attempts to open applicant's resume	2.81	2.14	<b>0.67 (0.00)</b>		
Email request to re-send resume	0.31	0.19	<b>0.13 (0.00)</b>		
<b>Panel B: Effect of signal about unemployment on information acquisition</b>					
	No information (N) (n=372)	2 months unemployed (2M) (n=187)	18 months unemployed (18M) (n=186)	p.p. difference: N-2M (p-value)	p.p. difference: N-18M (p-value)
Opening applicant's resume	0.83	0.73	0.73	<b>10 (0.01)</b>	<b>10 (0.00)</b>
Number of attempts to open applicant's resume	2.66	2.51	2.04	0.15 (0.56)	<b>0.63 (0.01)</b>
Email request to re-send resume	0.27	0.26	0.18	2 (0.66)	<b>9 (0.02)</b>

*Notes:* Means. Standard deviations in parentheses. Panel A reports how information acquisition is affected by name and Panel B reports how it is affected by the signal about recent unemployment. In Column 3 of Panel A and Columns 4-5 of Panel B we report differences in means between White majority and ethnic minority group, in the parentheses we report p-value for a t-test testing the null hypothesis that the difference is zero. The differences in the number of attempts to open an applicant's resume are reported in absolute terms, not in percentage points.

Interestingly, the gap is greater at higher levels of effort. The likelihood of clicking on the resume link at least once is 75% for minority applicants and it increases by 8% for majority applicants (to 81%). For the number of times an employer tried to open the resume the difference is 31% (2.1 for minority and 2.8 for majority applicants). Finally, the magnitude of the difference in whether the employer sent an email and requested the resume to be resent is 68% (19% for minority and 31% for majority applicants).

Next, we explore the effect of signaling recent unemployment on attention, i.e. the effect of an unambiguously negative signal about the applicant's quality. We find that employers consistently adjust their attention based on such information. Compared to the baseline condition with no information about unemployment history, indicating an 18-month-unemployment significantly reduces all three measures of information-acquisition effort (Panel B of Table V and Columns 1, 3 and 5 of Table VI).

**Observation 7:** A signal of an applicant's lower quality, observed by an employer prior to reading a resume reduces an employers' attention to the resume.

**Table VI:** German Labor Market—Information Acquisition by Ethnicity, Regression Analysis

Dependent variable	Number of attempts					
	Opening applicant's resume		to open applicant's resume		Email request to re-send resume	
	(1)	(2)	(3)	(4)	(5)	(6)
Ethnic minority name	-0.06*	-0.02	-0.68***	-0.82***	-0.15***	-0.14***
	(0.03)	(0.05)	(0.20)	(0.28)	(0.03)	(0.04)
2 months unemployed	-0.10**	-0.04	-0.10	-0.09	-0.01	0.02
	(0.04)	(0.06)	(0.24)	(0.35)	(0.04)	(0.05)
18 months unemployed	-0.12***	-0.10*	-0.64***	-0.92***	-0.07**	-0.08*
	(0.04)	(0.06)	(0.24)	(0.34)	(0.03)	(0.04)
Ethnic minority name*2 months unemployed		-0.11		-0.01		-0.06
		(0.09)		(0.48)		(0.06)
Ethnic minority name*18 months unemployed		-0.03		0.57		0.01
		(0.08)		(0.49)		(0.08)
Observations	745	745	745	745	745	745

*Notes:* Probit, marginal effects (dF/dx) in Columns 1-2 and 5-6, OLS in Columns 3-4. Robust standard errors in parentheses. \*\*\* denotes significance at the 1% level, \*\* at the 5% level and \* at the 10% level. In all columns the omitted variable is a White majority name and we control for dummy variables indicating required high school education, required previous experience, position in a city with more than million inhabitants, application being sent in holiday period (August), and a set of four dummy variables indicating the sector (manufacturing and construction, information and communication, administration, and professional, scientific and technical activities).

Similarly as in the case of name effects, we find the magnitude of the gap in attention increases at higher levels of effort to acquire a resume. The difference between the baseline condition and the 18-month unemployment condition is 13% for the likelihood of opening a resume, 23% for the number of attempts to open a resume, and 33% for the likelihood of requesting the resume be re-sent. The effect of the 2-month unemployment condition is generally smaller in size and less significant statistically (Table VI).

Last, we do not find evidence of a systematic interaction effect of minority names and unemployment conditions on attention (Columns 2, 4 and 6). In other words, the 18-month unemployment condition lowers an employer's effort to read a resume for both minority as well as majority applicants. Also, in the baseline condition, which is most comparable to the labor market experiment in the Czech Republic, the minority name significantly lowers the number of clicks on the resume as well as the likelihood of requesting the resume to be re-sent. The negative effect is small and statistically insignificant for the likelihood of opening a resume.

## V. LINKS TO THEORIES

We now consider which models can explain the set of findings from the three field experiments. Although it is likely that the observed discrimination in terms of

invitation rates arises, at least in part, due to reasons highlighted in standard economic models of discrimination—preference-based and statistical discrimination models—, these models cannot explain the complete set of findings, in particular the observed discrimination in attention, an important input for selection decision.

In purely preference-based models of discrimination, individuals do not discriminate due to lack of information and thus imperfect information and attention do not enter the model. There are several models that generate discrimination via imperfect information. Their common feature is that all observable actions prior to selection decisions are the same and discrimination arises at the moment of selection decision when the imperfect information is used. In the first class of statistical discrimination models decision makers take into account observable individual characteristics, while using an observable group attribute, such as ethnicity, to proxy unobservable individual quality (Phelps 1972, Arrow 1973).

The second class of statistical discrimination models emphasizes a lower precision of observable signals as a source of discrimination (Aigner and Cain 1977). Specifically, signals about individuals that economic agents receive are more precise for majority applicants compared to minority applicants, perhaps due to cultural dissimilarity (Cornell and Welch 1996). Thus, the difference in the precision of information about individuals across ethnic groups is assumed, i.e. is exogenous, and is not due to differences in efforts to acquire information. In contrast to these models, the experiments reveal that discrimination begins earlier, already during the information-acquisition stage, creating differences in information imperfection across groups at the moment when agents finally make decisions.

Do decision-makers allocate attention in order to maximize the expected value of acquired information, as described in our model? To assess that, we consider whether it can explain the main findings: (i) In the labor market employers pay more attention to majority compared to minority candidates, while in the rental housing market landlords pay more attention to minority compared to majority candidates. (ii) The gap in resume acquisition is greater when acquiring a resume requires writing an email requesting re-sending a resume compared to simple clicking on a hyperlink. (iii)

Signaling recent unemployment—another type of negative signal besides a minority name—lowers attention to an applicant on the labor market, similarly as minority name does.

First, the model predicts a switch in relative attention if markets differ in selectivity. In the labor market, where selectivity is high—since firms select only a few top applicants for an interview—the expected benefits from reading a resume are smallest for the group with the lowest expected quality, while the benefits of inspection are greater for this group in the housing market, where the overall invitation rate is high. Second, it predicts that at low costs of information acquisition the increased cost increases the motivation of the decision-maker to optimize attention and thus the gap in resume acquisition is predicted to increase when an employer needs to write an email compared to clicking on a hyperlink in order to get a resume. Third, it implies that any signal of an applicant's quality should affect attention to subsequent information, independently of whether the signal concerns ethnic status or some other characteristic relevant for beliefs about quality, such as signaling recent unemployment. Thus, we conclude the predictions of the model are consistent with all three empirical findings.

It should be noted that the selection of tenants by landlords differs from the hiring decisions of employers in many ways, and thus attributing the switching results to differences in selectivity needs to be taken cautiously. For example, a desired applicant's qualities may differ across the markets—landlords may be concerned about a tenant's ability to reliably pay rent and not cause property damage, while employers may focus on the type of education and qualifications relevant for a given job. If minority applicants were considered a priori better tenants and worse employees, then such a combination of beliefs could, in principle, explain the observed switch. However, in light of the observed discrimination in selection decisions, it is likely that minorities are negatively stereotyped in both markets.

Similarly, the expectation of relative precision of available signals (Aigner and Cain 1977, Cornell and Welch 1996) may also differ across markets. Our model would predict more attention to groups with more precise signals since the benefit of

paying a unit of attention to such groups is higher. The switch in relative attention could then be explained if the expected precision of the available signals also switched, i.e. if employers expected signals about minorities to be less informative, while landlords expected the same about majority applicants. Next, it is also possible that knowing more about minority applicants may be more important for a landlord than for an HR manager, perhaps because landlords may be more likely to interact intensively with tenants than HR managers with employees. However, the importance of the decision is predicted to affect overall levels of attention and thus influence the magnitude of attention discrimination, but it is not predicted to lead to a switch in relative attention across groups. Potentially, there might be other differences across markets, which could explain the switch, although the explanation based on differences in selectivity seems to be the most parsimonious.

While we propose a model in which decision-makers consciously allocate attention based on expected benefits in each instance, the observed attention choices of employers and landlords in the experiments may be conscious as well as automatic based on simplifying screening heuristics. The latter explanation is supported by intriguing evidence from Implicit Association Tests, which show that people often harbor unconscious bias against negatively-stereotyped groups, termed implicit discrimination (Bertrand, Chugh and Mullainathan 2005, Stanley, Phelps and Benaji 2008), when they make quick automatic decisions. Our model can help to explain why such discrimination heuristics may arise in the first place, for example by trial and error or by an initial conscious setting of screening rules that prove to work reasonably well and are later used automatically.<sup>23</sup>

## **VI. CONCLUDING REMARKS**

One of the main insights from information economics is that even very small frictions in information acquisition can have large effects on economic outcomes (Diamond

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<sup>23</sup> There is one observation from the German labor market which points to conscious decision making. While discrimination due to sub-conscious reasons is most likely to arise when the process of information acquisition involves automatic activity, such as clicking on an applicant's resume, we find that the gap in resume acquisition increases when the activity becomes more costly, i.e. when getting a resume requires writing an email.

1971, Sims 2003). At the same time, imperfect information is central to explaining discrimination in markets since the seminal work of Phelps (1972) and Arrow (1973). Yet, there is no theory or direct evidence studying how the small costs of information acquisition may create differences in the form of imperfect information about individuals based on their observable group attributes. This is what we provide.

We first describe how choices of attention affect discrimination in theory. We show that if attention is costly, prior beliefs about ethnic groups enter the final decision not only through Bayesian updating, as in the standard model of statistical discrimination, but also earlier through the choice of attention to available information (“attention discrimination”). As a result, prior beliefs have the potential for a larger impact on discrimination (in most types of markets) and discrimination in the selection of applicants can arise even when the decision makers have the same preferences across different groups, when all the relevant information is available, and when obtaining information about different groups is equally difficult.

In the empirical part, we identify attention discrimination in practice. We develop new tools for a correspondence field experiment using the Internet, and monitor information acquisition by employers and landlords about applicants prior to a selection decision for a job interview and an apartment viewing. A set of three experiments in two countries reveals that signals of an applicant’s minority status systematically affect attention to easily available information about the applicant (e.g., resume). In line with the model, the observed patterns of attention allocation are consistent with economic agents considering reading applications for a job or apartment as a costly activity and choosing the level of attention with an eye for expected benefits of reading, taking into account an applicant’s observable characteristics and desired level of quality in a given market. We also discuss alternative interpretations.

The key insight that willingness to process information at hand represents an additional barrier for applicants with unfavorable group attributes points towards several promising directions for future research as well as thoughts about policy, and we mention a few. First, the model implies the important role of the timing of when a

group attribute is revealed—the later a decision maker learns a group attribute, such as name, the smaller the asymmetry in attention to subsequent information such as education or qualification. It is intriguing that employers in the public as well as private sector have recently started to introduce name-blind resumes,<sup>24</sup> in part because researchers produced evidence indicating that blind auditioning (Goldin and Rouse 2000) and name-blind resumes (Skans and Åslund 2012) can reduce discrimination. Understanding practical implications of attention discrimination and which policies may be the most appropriate to attenuate it, without imposing too many restrictions on a firm’s choices, is an important area to explore. Second, the lower predicted and observed attention to negatively stereotyped groups in selective markets can help explain why African-Americans and minorities were found to face lower returns to higher quality resumes in the labor markets in the US and Sweden, respectively (Bertrand and Mullainathan 2004, Bursell 2007). Based on this, we speculate that in the long-term endogenous attention lowers incentives of negatively stereotyped groups to acquire human capital in the first place, and could make beliefs about differences in quality potentially self-fulfilling. Third, if the effect of recent unemployment on the attention of employers is similar when unemployment is signaled in the introductory email, as in our experiment, just as when it is reported in the resume, then endogenous attention may also contribute to greater long-term unemployment.

In addition to presenting novel empirical findings, the experimental design distinguishes itself by offering a methodological contribution. Our analysis joins efforts in laboratory settings to test decision-making processes with enhanced measurement tools, in particular by monitoring information acquisition (Camerer, Johnson, Ryman and Sen 1993, Costa-Gomes, Crawford and Broseta 2001, Gabaix, Laibson, Moloche and Weinberg 2006). We show that the widespread use of the Internet by economic decision makers opens the possibility of collecting “process data” as a part of a natural field experiment as well. By this, researchers can study in greater detail the processes taking place inside the “black box” and can better inform

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<sup>24</sup> Name-blind resumes have recently been implemented for hiring workers in the public sector in Belgium, the Netherlands and Sweden. The policy is being piloted in Germany among several major companies, including Deutsche Post, Deutsche Telekom, L’Oréal and Procter & Gamble.

theories and policy-makers on issues, including those that are sensitive and hard to study in the laboratory (Levitt and List 2007), of which discrimination is one important example.

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