warm glow cannot be distinguished from pure altruism, right?
This will be true if the employer's payoff is monotonic in worker's effort!

Discrimination in an Online Labor Market

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1 Model and Treatments

Assuming risk neutrality, a worker $i \in \{B, W\}$ solves the following problem when working for an employer $j \in \{B, W\}$ where B and W denote the black or white race of an agent (employer or worker) respectively;

$$\underbrace{max}_{e_{ij} \geq 0} U_{ij} = \underbrace{max}_{e_{ij} \geq 0} \left(F + (s_i + p)e_{ij} - c(e_{ij}) + \alpha_{ij} \left(v - p\right) e_{ij}\right) \tag{1}$$

where e_{ij} is the number of points (on a button-pressing task) scored by worker i when working for employer j, F is the fixed money paid for participating in the experiment, s_i (as in Dellavigna and Pope (2018)) captures the sense of duty, norm, intrinsic motivation, and competitiveness of worker towards the task. p is the piece rate per unit of effort. The term $\alpha_{ij} \left(v - p\right) e_{ij}$ models social preference towards the employer a' al DellaVigna, List, Malmendier, and Rao (2016).α_{ij} is the altruism parameter by worker i towards the employer j, it captures the worker's sensitivity to employer's payoff. We postulate $\alpha_{ij} = \alpha_i + d_{ij}$, i.e. α_{ij} consists of two additive components 1) α_i, which captures the sensitivity to employer's return (altruism) independent of employer's identity and 2) d_{ij}, which captures the discrimination in altruism based on the employer's j identity. d_{ij} can be considered as the taste (or distaste if $d_{ij} < 0$) of the worker i towards the employer j a' la Becker (1957). v is the exogenous per unit return (value) to employer from worker's effort.

$c(e_{ij})$ is the cost of effort, which is assumed to be same for all workers i. We assume the

regularity conditions $C'() > 0$, $C''() > 0$, and $lim_{e\to\infty} C'(e) = \infty$. Following Dellavigna and Pope (2018) we assume cost function to be a power function or exponential function i.e.

$$c(e) = \frac{ke^{1+\gamma}}{1+\gamma} \tag{2}$$

or

$$c(e) = \frac{kexp^{\gamma e}}{\gamma} \tag{3}$$

These functions differ in their elasticity of effort with respect to the value of effort. Power cost function 2characterize a constant elasticity of effort given by $1/\gamma$ while exponential cost function 3 implies a decreasing elasticity as effort increases. Both functions requires the estimation of unknowns k, and γ which we will back out using observed effort at different piece rates.

Solving 1 leads to following solution (when interior);

$$e^{\star}_{ij} = c'^{-1}\left(s_i + p + \alpha_{ij}(v-p)\right)$$

With power cost function this translates to;

$$e^{\star}_{ij} = \left(\frac{s_i + p + \alpha_{ij}(v-p)}{k}\right)^{1/\gamma}$$

While exponential cost function lead to the solution

$$e^{\star}_{ij} = \frac{1}{\gamma} log\left(\frac{s_i + p + \alpha_{ij}(v-p)}{k}\right)$$

Given the above set-up, we design our treatments to be able to identify k, γ, s_i, and α_{ij}. We make a simplifying assumption that the workers of type i are homogeneous given a treatment i.e. they will make the same effort choice in a given treatment.

1.1 Baseline Treatment

We design baseline treatment to identify baseline parameters of the above model (i.e. γ, k and s_i). So to ensure that other parameter values are set to zero, we do following;

1) Employer's identity is not revealed to worker ensuring $d_{ij} = 0$, i.e. there is no taste/distaste towards the employer's identity because the identity is not revealed, 2) Employer do not earn anything from worker's effort ensuring $\alpha_{ij} = 0$. This implied that the effort in this treatment is given as;

$$e_{ij}^{\star} = c'^{-1}(s_i + p)$$

This treatment will give us the baseline measure of effort of worker i for the given piece rate p. For each i, the solution of effort has one behavioral unknown (s_i), and two unknowns from cost function (k and γ). To back out these parameters we use effort corresponding to three different piece rates which gives us three equations to identify three parameters. Using 3 values for piece rate, we can exactly identify the 3 unknown parameters. These piece rates provide evidence on the responsiveness of effort to incentives for this particular task and hence allow us to estimate baseline parameters which will be used to estimate other behavioral parameters. To operationalize this treatment, we do not mention anything about the employer to the workers and rather ask them to work at a given piece rate. Hence their is no room for altruistic preferences here. This gives us three treatments;

1. Baseline - p_1 cents
2. Baseline - p_2 cents
3. Baseline - p_3 cents
4. Baseline - p_4 cents

1.2 Altruistic Treatment

In this treatment, we once again do not reveal the identity of the employer (i.e. $d_{ij} = 0 \implies \alpha_{ij} = \alpha_i$) however workers know the return to the employer v. This implies the effort in this treatment (at 0 piece rate) is given as;

$$e_{ij}^{\star} = c'^{-1}(s_i + \alpha_i(v))$$

Workers won't be paid anything for their effort in this treatment, however they will be informed that their matched employer will be paid v cents per unit of their effort.

1.3 Altruistic Treatment with Employer Identity

In this treatment, we reveal the identity of the employer hence allowing for $d_{ij} \neq 0$ and workers know the return to the employer (v). This implies the effort in this treatment (at 0 piece rate) is given as;

$$e^{\star}_{ij} = c'^{-1}\left(s_i + (\alpha_i + d_{ij})(v)\right)$$

Workers won't be paid anything for their effort in this treatment, however they will be informed that their matched employer will be paid v cents per unit of their effort. This gives us two treatments;

1. Altruistic Treatment with Black Employer
2. Altruistic Treatment with White Employer

2 Experiment Design

The main goal of this study is to document the evidence of discrimination in the online labor market. We designed the experiment to allow for the possibility of discrimination in effort by workers towards the employers. Our experiment is carefully designed to ensure that observed difference in effort could only realize because of the taste bias of workers.

2.1 Recruitment of Subjects

The subjects for this experiment will be recruited from an online labor market, Amazon's Mechanical Turk. Mechanical Turk is a crowd-sourcing web-service that allows employers (called requester) to get tasks (called Human Intelligence Tasks (HITs)) executed by employees (called workers) in exchange for a wage (called reward). Mechanical Turk is a widely used platform in research in economics and give access to large pool of applicants at a much affordable rate hence allowing for the well powered study. See Paolacci, Chandler,

and Ipeirotis (2010) and Paolacci and Chandler (2014) for discussion on demographic characteristics and representation of subjects from Mechanical Turk.

2.1.1 Recruitment of Employers

We need to recruit employers only for altruistic treatments. The only reason for recruiting employers is to avoid deception otherwise the purpose of this study is not to investigate employer's behavior. We recruit employers before we recruit workers and we only need to recruit 1 employer for Altruistic treatment, 1 Black employer for altruistic with Black employer treatment and 1 White employer for altruistic with White employer treatment. These three employers will be recruited by posting an assignment for a demographic survey on M-Turk. Subjects will be informed that they will be matched to multiple workers on M-Turk who will work on a task and based on the performance of one of those randomly selected worker they will be rewarded with bonus at the rate of ve_{ij} where e_{ij} will be the output of randomly matched worker.

2.1.2 Recruitment of Workers

To recruit workers for this experiment, we will post the assignment for screen-er survey on M-Turk and only White (Black?) people will be allowed to participate in the experiment.

2.2 Sample Size

Since our choice of task is same as Dellavigna and Pope (2018), we can use results from their study to determine the sample size that can achieve sufficient power for our study. Dellavigna and Pope (2018) found that the points scored in each treatment have a standard deviation of around 660 points. Assuming this standard deviation for each treatment and assuming a minimum detectable effect of 185 points between two treatments, we will need around 200 observations in each sub-treatment to have a power of 80 percent. This implies that we will need 200 x 7= 1,400 workers in total for all 7 treatments.

2.3 Task

We designed this experiment to observe whether workers discriminate in their effort when working for different employer types and then to back out the behavioral parameter of distaste. For this purpose we needed a task which is costly to workers. We settled on a button-pressing task as in Dellavigna and Pope (2018). The task involves alternating presses of "a" and "b" on keyboard for 10 minutes. We settled on this task because it is simple to understand and have features that parallel clerical jobs: it involves repetition and it gets tiring, thus testing the motivation of the workers.

2.4 Race Revelation

There are multiple options here;

1. Ask employers to take a picture of the back of their hand and show that to workers saying something like "Picture is showed to ensure that you are playing with a real person".

2. Reveal the stated profile of employer to workers (age, gender, education and race). Seems contrived?

3. Forget about deception and use pictures from Chicago Face Database.

4. Recruit black and white people from department and use their pictures to reveal race. Need enough variety of blacks and whites. We will actually pay these people so no deception here. The added issue is M-Turk population may behave differently knowing that these people are not from M-Turk.

5. Find real race salient employers to whom the proceeds will be transferred from worker's effort (like charities in DellaVigna et al. 2016).

References

Becker, G. S. (1957). *The economics of discrimination*. University of Chicago Press.

DellaVigna, S., List, J. A., Malmendier, U., & Rao, G. (2016). Estimating social preferences and gift exchange at work. *NBER Working Paper Series*, *53*(9), 1689–1699. doi: 10.1017/CBO9781107415324.004

Dellavigna, S., & Pope, D. (2018). What motivates effort? Evidence and expert forecasts. *Review of Economic Studies*, *85*(2), 1029–1069.

Paolacci, G., & Chandler, J. (2014). Inside the Turk: Understanding Mechanical Turk as a Participant Pool. *Current Directions in Psychological Science*, *23*(3), 184–188.

Paolacci, G., Chandler, J., & Ipeirotis, P. (2010). Running experiments on amazon mechanical turk. *Judgment and Decision making*, *5*(5), 411–419.