

# **Circumstances, Effort Choice and Redistribution**

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1. Motivation
2. Theoretical Analysis
3. Experimental Design
4. Experimental Results
5. Takeaway

- Whether income inequality is considered fair affects which inequalities people tolerate, and which policies they prefer
- Studies show that the majority of people - called meritocrats - care about what causes income inequality: factors that agents can control (ex: effort) or not.<sup>1</sup>
- However, uncertainty is prevalent: did a person succeed because they were hard-working or did they just get lucky?
- I introduce a new source of income inequality: individual circumstances
- Unlike luck, circumstances are known to the agent
- They may have important effects on (1) effort, (2) beliefs about what causes income inequality and, (3) redistribution
  - (1) How do circumstances affect agent's effort choice?
  - (2) Do people attribute success to hard work, higher luck or to better circumstances?
  - (3) How does the level of heterogeneity in circumstances affect beliefs and income redistribution?

## Motivating Example

- Student has to achieve a target rating to enter a selective university
- Rating is achieved through a combination of circumstances, luck and costly effort<sup>2</sup>
- *Ex post* observation is coarse: the student is admitted or not
- Student's incentives depend on circumstances
- **Questions:** to what extent is success attributable to effort vs luck vs circumstances, and what are the implications for redistribution?

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<sup>2</sup>For example, each applicant to Harvard receives an overall rating based on four dimensions: academic, athletic, personal, and extracurricular

## Theoretical Analysis

## 1. Individual production depends on circumstances, effort, and luck

$$P_i = \underbrace{\kappa_i}_{\text{circumstances}} + \underbrace{\lambda_i e_i}_{\text{luck*effort}}$$

$\lambda_i \sim \mathcal{U} [0, \bar{\lambda}]$ , and  $\kappa_i \sim \mathcal{U} [\kappa - \delta, \kappa + \delta]$

$\delta$  captures heterogeneity in circumstances

## 2. Outcome is binary and does not perfectly reflect production

Exogenous target  $T$ . Worker succeeds and earns  $x$  if  $P_i \geq T$ ; otherwise fails and earns  $0$

## 3. Timing

- **Production:** Worker  $i$  knows circumstances  $\kappa_i$  but not their luck  $\lambda_i$ , then chooses how much effort to exert. Success is never guaranteed since  $\kappa_i < T$
- **Redistribution:** Third party observes a pair of workers' outcome. If outcomes differ, she chooses how to redistribute the earnings between the workers. Preferences

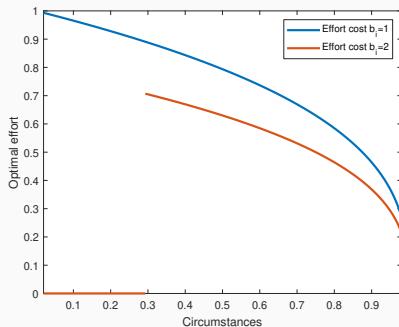
# Model Results

## Proposition 1 (Comparative Statics) :

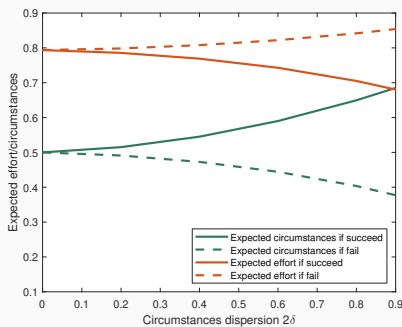
If the optimal effort is positive, then it is decreasing in circumstances  $\kappa_i$

## Proposition 2 (Expected Effort) :

When there is heterogeneity in circumstances ( $\delta > 0$ ), the expected effort conditional on success is *lower* than conditional on failure



(a) Optimal effort  $e_i^*$



(b) Third party beliefs

- Simulation with:  $\kappa = .5$ ,  $\delta = .49$ ,  $\bar{\lambda} = x = s_i = 1$ ,  $c(e_i) = b \frac{e_i^2}{2}$

Optimal Effort

## Experimental Design

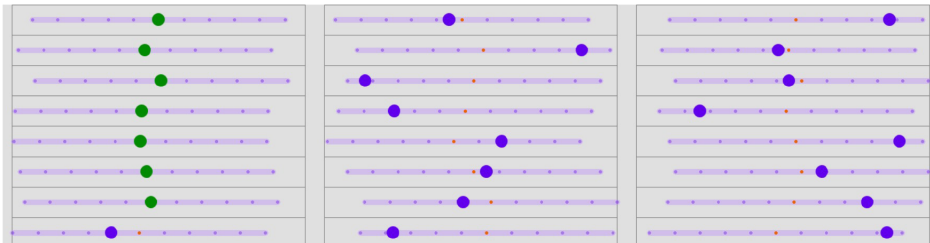


# Real-Effort Task (Gill & Prowse - AER, 2012)

## Slider task

Time to complete the stage: 44:20

Current slider score: 7 Starting line: 400 Multiplier: between 0 and 10



- Experiment conducted with 87 participants in the Missouri Social Science Experimental Laboratory (MISSEL) at Washington University in St. Louis in April 2023
- Five sessions of 90 minutes, average earnings \$21.82

Treatments

Beliefs Elicitation

## Preview of The Experimental Results

### Worker's effort

- Workers with better circumstances exert less effort, yet succeed more
- *Demotivation effect*: 87% of workers who provide no effort receive circumstances below the median

### Beliefs

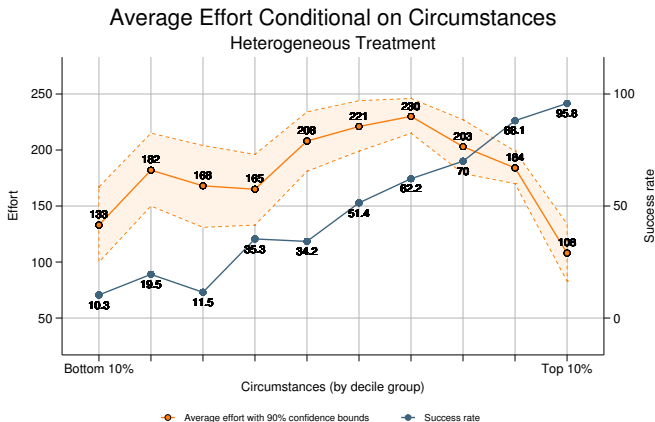
Two-thirds of participants attribute success to both higher effort and better circumstances

### Third party redistribution

Income redistribution reflects meritocratic preferences, but only when circumstances are known in addition to the outcomes

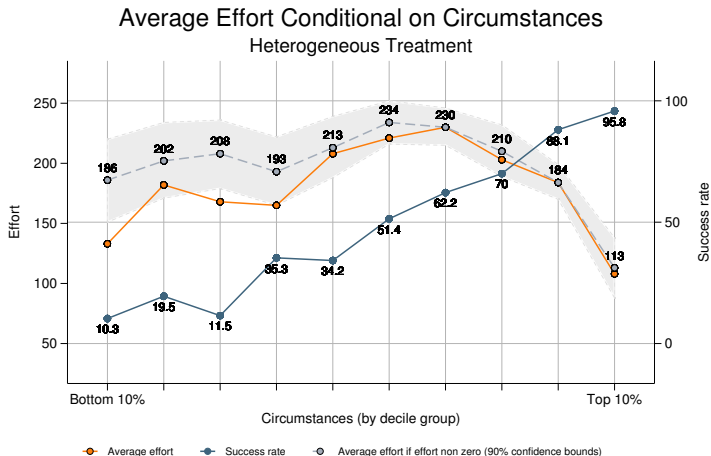
## Experimental Results

# Effort and Success Rate by Circumstances

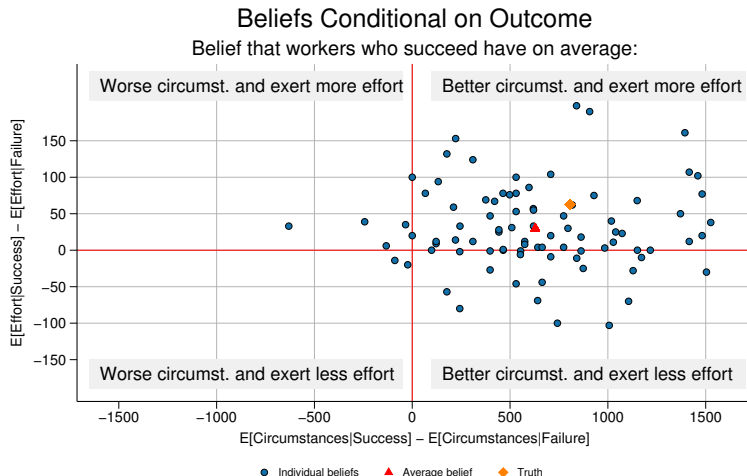


- The success rate is increasing in circumstances
- **In the top decile, people exert less effort yet succeed more**
- Negative correlation between circumstances and effort above the median of the circumstances distribution:  $\rho = -.43$  ( $p < .01$ )

# Demotivation Effect



- In 8% of the observations, workers exert zero effort
  - In 87% of those observations, workers have circumstances below the median
- Causes



- In line with data and theory, 91% believe that those who succeed come from better circumstances
- In line with data but *not* the theory, 70% believe that those who succeed exert more effort

## Stage 3: Combining Effort and Redistribution

Participant plays two distinct roles: worker and third party

### **Worker**

- Perform one round of real effort task
- After the task, "one-winner" pairs are formed. A bonus is by default allocated to the worker who succeeds in the pair

### **Third party**

- May redistribute earnings within two pairs
- Third party knows the workers' circumstances

## Redistribution With Known Circumstances

**Table 3:** Redistribution with known circumstances

		Member who succeeds in pair has	
		All	
			Better circumstances    Worse circumstances
Mean share redistributed		0.380 (0.257)	0.403 (0.236) <b>0.267</b> (0.328)
Median share redistributed		0.425	0.45    0.15
Share split 50-50		0.299	<b>0.338</b> 0.103
Share don't redistribute		0.149	0.103 <b>0.379</b>
Average circumstances	if succeed	1525	1698    663
	if fail	761	655    1290
Mean belief about effort (Truth)	if succeed	214 (245)	<b>206</b> (242) <b>254</b> (261)
	if fail	187 (198)	186 (189)    192 (241)
Observations		174	145    29

- Less redistribution if the winner starts with worse circumstances ( $p < .01$ )
- This seems driven by the belief that those who succeed exert about 30% more effort (254 vs 192,  $p < .01$ )
- The larger the difference in circumstances between the workers, the higher the redistribution



1. In real life, we tend to believe that success is positively correlated with effort. When I introduce circumstances, success is instead negatively correlated with effort  
⇒ In the experiment, workers with better circumstances exert less effort, yet succeed more
2. Circumstances complicate inferences about what causes inequality because effort is endogenous to circumstances  
⇒ 2/3 of third parties attribute success to both better circumstances and higher effort
3. If people observe differences in circumstances, they take them into account when they redistribute income
4. People may disagree about how much heterogeneity in circumstances there is, which will cause them to make different inferences

## Appendix

## Beliefs if Succeed: Identical Treatments (H3)

**Table 6:** Beliefs conditional on success (Identical treatments)

		Treatment		
		Identical-Low	Identical-High	Difference
Average effort if reach	Truth	259	228	31***
	Belief	215	197	18**
	$\Delta$ Belief - Truth	-44	-31	
Average luck if reach	Truth	7.4	12.5	5.1***
	Belief	6.8	11.9	5.1***
	$\Delta$ Belief - Truth	-0.6	-0.6	

Two-sample t-test: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- Success is attributed to luck in *IH* and effort in *IL* (in line with the data). Underestimation in both treatments
- Within treatment, subjects believe that those who succeed exert more effort and are luckier

## Beliefs if Fail: Identical Treatments

**Table 7:** Beliefs conditional on failure (Identical treatments)  
Treatment

		Identical-Low	Identical-High	Difference
Average effort if miss	Truth	190	161	29
	Belief	164	151	13
	$\Delta$ Belief - Truth	-26	-10	
Average luck if miss	Truth	3.0	4.8	1.8**
	Belief	3.6	6.1	2.5***
	$\Delta$ Belief - Truth	+0.6	+1.3	

Two-sample t-test: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

[back](#)

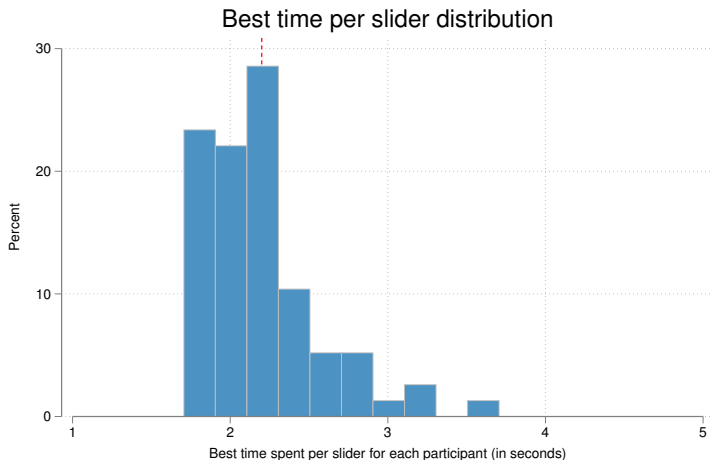
## Beliefs Conditional on Outcome: Heterogeneous

**Table 8:** Beliefs conditional on outcome (Heterogeneous treatment)

		Outcome		Difference
		Reach	Miss	
Average effort	Truth	216	154	63***
	Belief	205	175	30***
	$\Delta$ Belief - Truth	-11	+21	
Average luck	Truth	6.8	3.7	3.1***
	Belief	6.5	3.8	2.6***
	$\Delta$ Belief - Truth	-0.3	+0.1	
Average circumstances	Truth	1649	843	807***
	Belief	1497	868	629***
	$\Delta$ Belief - Truth	-152	+25	

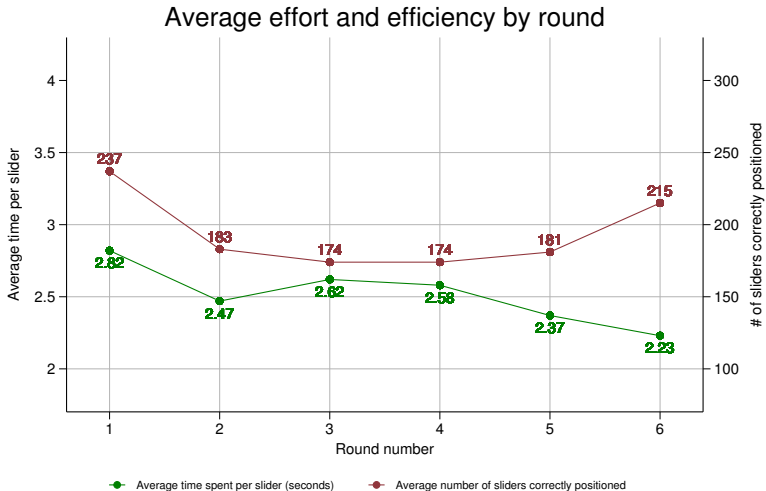
Two sample and paired (beliefs) t-test: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Ability: best time per slider distribution



Around two-thirds of participants spend between 1.75 and 2.25 seconds per slider. [back](#)

## Round effect



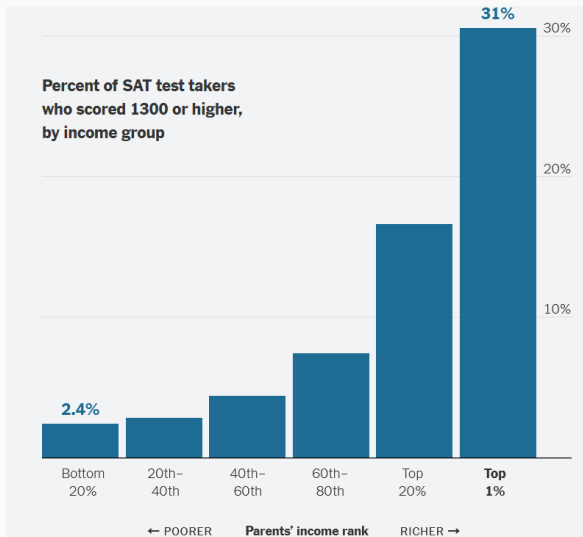
No evidence of fatigue. [back](#)

## Probability of Success

		Effort						
		1	50	100	150	200	250	300
Circumstances	0	0%	0%	0%	0%	0%	9%	18%
	500	0%	0%	0%	0%	9%	27%	36%
	1000	0%	0%	0%	9%	27%	45%	55%
	1250	0%	0%	0%	18%	36%	55%	55%
	1500	0%	0%	9%	36%	55%	64%	64%
	2000	0%	9%	55%	64%	73%	82%	82%
	2500	100%	100%	100%	100%	100%	100%	100%

**Figure 3:** Probability of success given effort and circumstances in heterogeneous treatment





**Figure 4:** Source: Chetty, Deming, Friedman (2023) illustration by The New York Times

**Table 9:** Treatments

Treatment	Parameters				
	$\kappa$	$\delta$	Luck distribution	Target production	Effort range
Identical-Low	1250	0	$\mathcal{U} [0, 10]$	2500	0-300
Identical-High	1250	0	$\mathcal{U} [0, 20]$	2500	0-300
Heterogeneous	1250	1250	$\mathcal{U} [0, 10]$	2500	0-300

- Identical-Low (baseline): identical circumstances, low luck variance
- Identical-High: same as baseline, but expected luck is twice higher than in *IL*
- Heterogeneous: randomly drawn circumstances

# Belief Elicitation

## For everyone in this round:

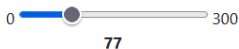
- the **starting line** was randomly selected **between 0 and 2500**. It varied among participants. Therefore, the starting line of other participants may have been different from yours.
- the **multiplier** was randomly selected **between 0 and 10**. It also varied among participants.

## Think of participants who **reached** the target in the current round.

What do you think is the average starting line of people who reached the target, excluding yourself?



What do you think is the average slider score (the number of correctly positioned sliders) of people who reached the target, excluding yourself?



What do you think is the average multiplier of participants who reached the target, excluding yourself?



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# What Causes Demotivation?

**Table 10:** Logit with dependent variable: choose no effort (demotivated)

	(1)
Circumstances (decile)	-0.431*** (0.104)
Treatment: Identical-Low	0.218 (0.808)
Treatment: Heterogeneous	0.633 (0.689)
Fail in round n-1	-0.465 (0.394)
Constant	-1.214 (0.873)
Round controls	Yes
Subject FE	Yes
Observations	435

Standard errors in parentheses, clustered at participant level.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- Rule out several explanations: high cost of effort, hedging between rounds, disappointment due to previous round failure
- Moving up in the circumstances distribution by one decile reduces probability of being demotivated by 2.8%

## Redistribution Conditional on the Outcome

**Table 11:** Redistribution descriptive statistics

	Source of income inequality					
	Luck only	Effort only	Treatments with uncertainty			
			All	IH	IL	Heter.
Mean share redistributed	0.439 (0.177)	0.341 (0.303)	0.351 (0.240)	0.339 (0.233)	0.349 (0.253)	0.361 (0.236)
Median share redistributed	0.5	0.3	0.35	0.35	0.35	0.4
Share split 50-50	<b>0.643</b>	0.172	0.230	0.230	0.195	0.264
Share don't redistribute	0.069	<b>0.253</b>	0.161	0.149	0.172	0.161
Observations	87	87	261	87	87	87

- Replicate literature results when source of inequality is known: compensate for lack of luck and reward effort.
- Redistribution pattern when the source of income inequality is uncertain is closer to *effort only*
- No significant difference in redistribution between treatments

## Redistribution Conditional on the Outcome

**Table 12:** Redistributed share

	(1)
Belief difference in effort	-0.040** (0.019)
Belief difference in luck	0.677 (0.416)
Belief difference in circumstances	-0.214 (0.458)
<i>Effort only</i> redistribution	0.165** (0.078)
<i>Luck only</i> redistribution	0.350*** (0.134)
Treatment dummy	Yes
Subject FE	Yes
Groups	87
Observations	261

OLS with subject Fixed Effects. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

- Preferences matter more than beliefs
- Third parties redistribute less when the gap between the expected effort of the worker who succeeds and the worker who fails increases

## The model (2) : Redistribution Phase

### A group is comprised of two workers $i$ and $j$ , and one third party

- Third party observes both workers' outcome, but not their effort, luck or circumstances
- If outcomes differ, third party chooses how to redistribute the earnings between the workers: chooses the share  $(s_i, s_j)$  to give to  $i$  when  $i$  succeeds and  $j$  fails, with  $s_j = 1 - s_i$
- Worker  $j$  may fail but still receives a positive payoff if  $P_i \geq T$  and  $s_j \neq 0$

### Third Party's Preference

$$U(s_i, f_i) = -(s_i - f_i)^2$$

- $f_i$  is what the third party considers the fair share for  $i$
- If the third party has meritocratic preferences,  $f_i$  depends on effort, luck, and circumstances

## The model (3) : Worker i's payoff

### Worker's problem

- Effort is costly with  $c'(e_i) > 0$ , and  $c''(e_i) > 0$
- Worker knows  $\kappa_i$ , but only knows distribution of luck  $\lambda_i$

$$\max_{e_i \geq 0} x p_i p_j + s_i x p_i (1 - p_j) + (1 - s_i) x (1 - p_i) p_j - c(e_i)$$

- where  $p_i$  is the probability that  $i$  reaches the target

$$p_i = \text{Prob}\left(\lambda_i \geq \frac{1 - \kappa_i}{e_i}\right) = \frac{e_i \bar{\lambda} + \kappa_i - 1}{e_i \bar{\lambda}}$$

and  $p_j$  the probability that  $j$  reaches the target.<sup>3</sup>

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<sup>3</sup>Target  $T$  is normalized to 1.



## Optimal effort

Maximizing w.r.t.  $e_i$ , assuming in the model  $c(e_i) = b \frac{e_i^2}{2}$ , we obtain:

$$e_i^* = \begin{cases} \left( \frac{x(1-\kappa_i)s_i}{b\bar{\lambda}} \right)^{\frac{1}{3}} & \text{if } \kappa_i > 1 - \bar{\lambda} \left( \frac{x s_i}{b} \right)^{\frac{1}{2}} \\ 0 & \text{otherwise} \end{cases}$$

## Proposition 1 (Comparative statics)

If the optimal effort is positive, then it is increasing in  $x$  and  $s_i$ , and decreasing in  $b$ ,  $\kappa_i$  and  $\bar{\lambda}$