Equitable screening

Filip Tokarski
Stanford GSB

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Perceived fairness matters

'Yellow Vest' Protests Shake France. Here's the Lesson for Climate Change.

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France's suspension of a fuel tax increase after violent protests signaled the perils that governments in wealthier countries may face in setting policies to fight climate change. Veronique De Viguerie/Getty Images

Politically, the backlash came from those who could least afford to give up their cars — small-town and suburban residents priced out of big cities and unhappy with Mr. Macron on a host of other issues

"This situation illustrates how equity and fairness considerations have to be built into the design of such policies," Alden Meyer, policy director at the Union of Concerned Scientists, said by email from the United Nations climate talks.

Modeling fairness constraints

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Modeling fairness constraints

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  - **Equally deserving** people get **equal allocations** of the good
- **Q:** What mechanisms satisfy **IC**, **IR** and the **equity constraint**?
- **A1**: With one screening device (payments or ordeals), can only offer a single option
- **A2**: But with both screening devices, we can implement a rich class of mechanisms

Literature

- **Algorithmic fairness**
  - (Dwork et al., 2012; Corbett-Davies et al., 2017; Hardt et al., 2016)
  - Focus on classification problems
  - **This paper:** agents have private information! Fairness when agents are strategic
- **Screening in social programs**
  - (Nichols and Zeckhauser, 1982; Besley and Coate, 1992; Akbarpour et al., 2020)
  - Focus on welfare and efficiency
  - **This paper:** adds explicit equity constraints

Model

Types and allocations

- Two-dimensional private type: $(\alpha, \beta) \in \Theta \subseteq \mathbb{R}^2$
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  - Θ is open, bounded and connected

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- The designer allocates the **good** $x \in [0, 1]$

  - The good can be emission rights, affordable housing, vaccines...

- She uses **payment** $p \in \mathbb{R}$ and **ordeals** $q \in \mathbb{R}_+$ as screening devices

  - Ordeals à la Nichols and Zeckhauser (1982): waiting in line, filling out forms...

Utilites and constraints

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- The designer chooses a mechanism $(x, p, q) : \Theta \to [0, 1] \times \mathbb{R} \times \mathbb{R}_+$ subject to:

$$\text{for all } (\alpha, \beta) \in \Theta, \quad U[\alpha, \beta; (x, p, q)(\alpha, \beta)] \geq \sup_{(\alpha', \beta') \in \Theta} U[\alpha, \beta; (x, p, q)(\alpha', \beta')], \quad \text{(IC)}$$

$$\text{for all } (\alpha, \beta) \in \Theta, \quad U[\alpha, \beta; (x, p, q)(\alpha, \beta)] \geq 0. \quad \text{(IR)}$$

Equity constraint

- The equity constraint is defined using the **merit function** $\eta : \Theta \to \mathbb{R}$
  - **Merit** $\eta(\alpha, \beta)$ measures how much type (α, β) **deserves the good**
  - **Poorer** (high α) and **high-need** (β) people deserve the good more: $\eta_\alpha, \eta_\beta > 0$

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Definition (Equitable allocation)

An allocation rule $x(\alpha, \beta)$ is equitable if all agents with equal merit η receive equal allocations of the good, that is, if:

$$\eta(\alpha^a, \beta^a) = \eta(\alpha^b, \beta^b) \quad \Longrightarrow \quad x(\alpha^a, \beta^a) = x(\alpha^b, \beta^b)$$

- Equivalent to $x(\alpha, \beta) \equiv \hat{x}(\eta(\alpha, \beta))$

What are the equitable and implementable allocations...

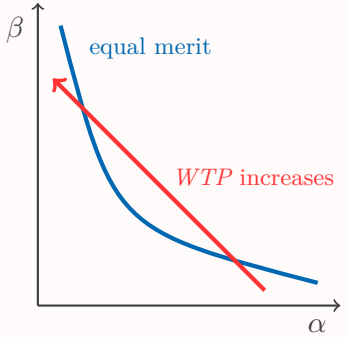
- ...when we screen **only with payments?**
- ...when we screen **only with ordeals?**
- ...when we screen **with payments and ordeals?**

Screening with payments

Screening with only payments

Proposition 1

Any equitable and implementable $x(\alpha, \beta)$ is the same for all $(\alpha, \beta) \in \Theta$.



- Payments bias the allocation towards the **rich**...
- ...but equity requires a bias towards the **poor**

Screening with ordeals

Screening with only ordeals

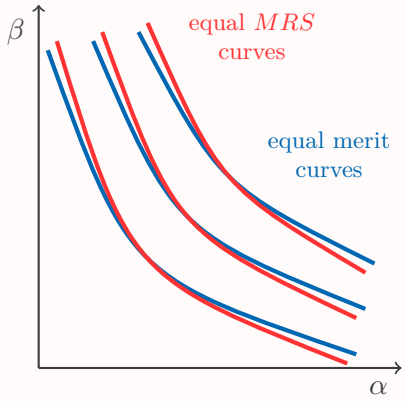
- Ordeals bias allocation towards the **poor**. Right direction! However:

> **Proposition 2**
>
> For a generic merit function η, any equitable and implementable $x(\alpha, \beta)$ is the same for all $(\alpha, \beta) \in \Theta$.

- Intuitively, equity requires that this bias take some exact form...

- ...but the planner has **too few degrees of freedom** to match it

Proposition 2: proof intuition



- Equity requires allocation $\hat{x}(\eta^*)$ for everyone with merit η^*

- FOCs at $\hat{x}(\eta^*)$ have to hold for all types with merit η^*

$$\frac{v_x(\beta, \hat{x}(\eta^*))}{z_q(\alpha, \hat{q}(\eta^*))} = \frac{\hat{q}'(\eta^*)}{\hat{x}'(\eta^*)}$$

Screening with payments and ordeals

Screening with payments and ordeals

- Impose more structure on utility function:

$$U[x, p, q, \alpha, \beta] = \beta x - w(\alpha)p - z(\alpha)q$$

- Need is strictly positive: $\beta > 0$
- Disutility of ordeals and payments is strictly positive: $w(\alpha), z(\alpha) > 0$

  + technical conditions

Screening with payments and ordeals

Theorem 1

An allocation rule $x(\alpha, \beta)$ is equitable and implementable if and only if

$$x(\alpha, \beta) \equiv \hat{x}(\eta(\alpha, \beta)),$$

where $\hat{x}$ is increasing.

- Now menu of payment options for every x—can pay in money p, ordeals q, or mix
- **Intuition**: composing such menus fixes 'too few degrees of freedom' issue

Also in the paper

1. What if the designer can observe agents' wealth?
2. Relaxing the equity constraint (measures of equity violation)

Conclusions

Take-aways

- With a **single instrument**, the space of equitable policies is very limited...
- ...but with **two screening devices**, one preferred by the rich and one by the poor...
- ...rich screening possible **even under extremely stringent equity constraints**

- **Practical suggestion?** Pair emission tolls with (laborious) rebate procedures

Thank you!