Finding Out Who You Are

A self-exploration view of education

SUNGMIN PARK

THE OHIO STATE UNIVERSITY

What I do

My question How useful is it to view education as a **statistical experiment** about oneself?

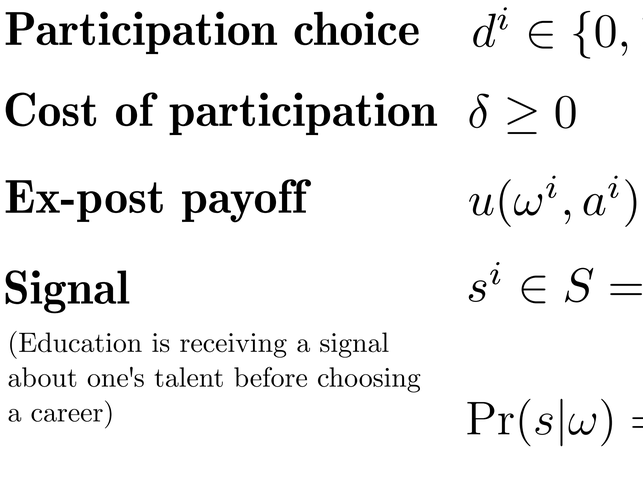
- People often say that education is not just for gaining knowledge or a diploma, but to "find out who you are"

My answer It is pretty useful, in studying the **value** and **design** of education

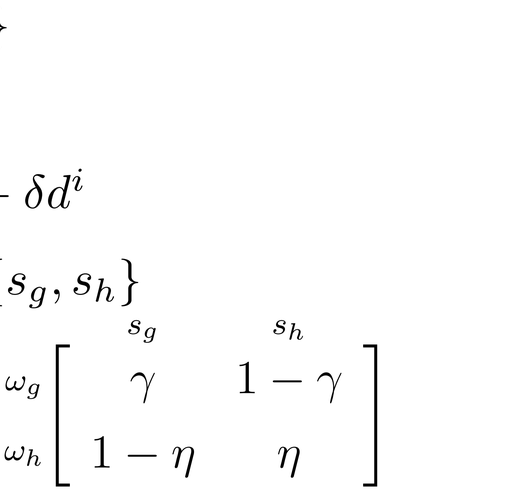
- **Main result**: An optimal educational structure **encourages** a field in which its participating students **on average** have **comparative advntage**
- **Application:** Advanced science classes in U.S. high schools are **informative** to students on their decisions to pursue science majors, but are **too science-encouraging**

Model

Students	$i \in I = \{1, 2, \ldots, n\}$
State or "Talent"	$\omega^i \in \Omega = \{\omega_g, \omega_h\}$ (talented in gathering or hunting)
Prior beliefs	$p^i = \Pr(\omega^i = \omega_h)$ (public and rational)
Action or "Career"	$a^i \in A = \{a_g, a_h\}$ (career in gathering or hunting)
"Productivity"	$u(\omega^i, a^i)$
"Mismatch costs" (better to choose a matching career)	$u_g = u(\omega_g, a_g) - u(\omega_g, a_h) > 0$ $u_h = u(\omega_h, a_h) - u(\omega_h, a_g) > 0$
Participation choice	$d^i \in \{0, 1\}$
Cost of participation	$\delta \geq 0$
Ex-post payoff	$u(\omega^i, a^i) - \delta d^i$
Signal (Education is receiving a signal about one's talent before choosing a career)	$s^i \in S = \{s_g, s_h\}$ $\Pr(s\|\omega) = \begin{array}{c} \\ \omega_g \\ \omega_h \end{array} \begin{array}{c} \begin{array}{cc} s_g & s_h \end{array} \\ \begin{bmatrix} \gamma & 1-\gamma \\ 1-\eta & \eta \end{bmatrix} \end{array}$
"Educational Structure"	$(\gamma, \eta) \in \Theta = \{(\gamma, \eta) \in [0,1]^2 \mid \gamma + \eta \geq 1\}$ $\gamma \geq \eta$ means gathering-encouraging. $\gamma \leq \eta$ means hunting-encouraging.
Feasible education	$C(\gamma, \eta) \leq B$ C is continuous, differentiable, strictly increasing, strictly convex, symmetric, and well-bahaved at the boundary. $\boldsymbol{B}>0$ is a constant.



Students' Education and Career Choices



Feasible Educattion

Results

Definition. A feasible education is **optimal** if it maximizes $W(\gamma, \eta)$, the sum of expected payoffs of all students. It is **nontrivial** if it has at least one participant.

Theorem 1 (Characterization).
Suppose (γ^*, η^*) is feasible and nontrivial.
Suppose $D^* \subset I$ is the set of participants under (γ^*, η^*).
Then (γ^*, η^*) is optimal if and only if

$$(\gamma^*, \eta^*) = F(\bar{p}_{D^*}), \text{ and}$$
$$D^* \in \operatorname*{argmax}_{D \in \mathcal{P}(I)} W\big(F(\bar{p}_D)\big),$$

where $\bar{p}_D$ is the average belief of a set D of students, and $F(p)$ is the solution (γ, η) of the sytem of equations

$$\frac{\frac{\partial}{\partial \gamma} C(\gamma, \eta)}{\frac{\partial}{\partial \eta} C(\gamma, \eta)} = \frac{1-p}{p} \frac{u_g}{u_h} \quad \text{and} \quad C(\gamma, \eta) = B.$$

→ The optimal structure depends only on the participants' average belief

Theorem 2 (Direction of encouragement).
Suppose (γ^*, η^*) is as in Theorem 1 and is optimal. Then

$$\bar{p}_{D^*} \leq \tfrac{u_g}{u_g+u_h} \Rightarrow \gamma^* \geq \eta^* \quad \text{and} \quad \bar{p}_{D^*} \geq \tfrac{u_g}{u_g+u_h} \Rightarrow \gamma^* \leq \eta^*$$

→ The optimal structure encourages gathering if participants are on average more confident in gathering, and the same goes for hunting

Empirical Application

Advanced science classes in U.S. high schools

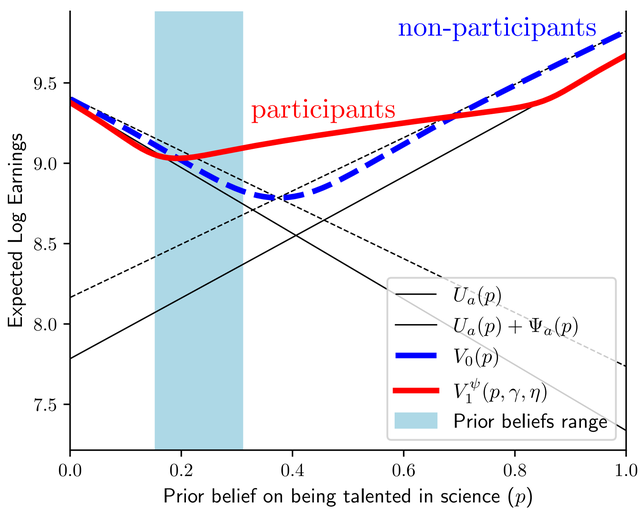
I **estimate** the model parameters using data of 6,638 U.S. high school students who were in 9th grade in 2009

- HSLS (High School Longitudinal Study) contains the data on their initial **self-confidence** in sciences, **participation** in AP science classes, and decisions to pursue **science majors** in college

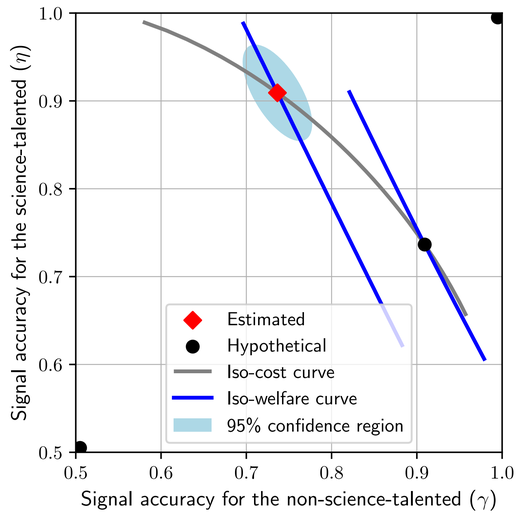
The classes are science-encouraging and is not optimal

Students' prior beliefs in science talent are ranged **10-30%**. The estimated structure is $(\mathbf{0.7}_{\text{non-science}}, \mathbf{0.9}_{\text{science}})$

- The value of these classes are **5%** increase on future income. Under the opposite structure (0.9, 0.7), it would be **12%**



Estimated Priors and the Value of Education



The Structure of AP Science Classes

Email park.2881@buckeyemail.osu.edu **Website** www.sungminparkecon.com