Endogenous Inequality in a Trade Model with Private Information*

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*Slides and Paper available at http://www.econ.umn.edu/~amoro/

Model with endogenous income inequality and comparative advantage.

Unlike previous literature:

- Countries identical in the fundamentals
- No increasing returns to scale or technological externalities
- No trade frictions
- No imperfect competition

Externality derived from the interaction between informational asymmetry and production technology

Main results:

- There are equilibria with specialization and trade
- In some circumstances, autarky is better for the "poor" country

Human Capital Investment

Continuum of workers with heterogeneous disutility from investment $c \sim G$.

Prior to entering the labor market, each worker chooses whether to invest or not. Those who invest become "qualified"

There are 2 goods, a "high technology good" x_1 and a "simple good" x_2

Preferences:

$$u(x_1, x_2) - c \text{ if invest}$$
$$u(x_1, x_2) \text{ otherwise}$$

Production

2 Labor inputs: complex and simple job

Important assumption: unqualified workers are not productive in the complex job

The high technology good is more intensive in complex labor, e.g. extreme assumption:

$$\begin{aligned} y^1(q,n) &= q \\ y^2(q,n) &= q+n \end{aligned}$$

n number of *unqualified* workers employed
q number of *qualified* workers employed

Information Technology

Firms do not observe workers' investment decision

Each worker takes a test that results in a score $\theta \in \{g, b\}$, correlated with qualification:

$$\Pr(\theta = g| \text{ investment}) > \Pr(\theta = g| \text{ no investment})$$

The problem of the Consumer

Normalize $p_2 = 1$

1) Consumption

$$\begin{aligned} v(w,p) &= \max_{x_1,x_2} u(x_1,x_2) \\ &\quad \text{s.t } p_1 \cdot x_1 + x_2 \leq w \end{aligned}$$

2) Human Capital Investment: invest if

$$c \leq \text{ incentives } B$$

The problem of the Firm

Firms choose "how many" workers to employ given signal θ.

Basic problem: evaluate workers' marginal product in each sector.

$\pi^h =$ proportion of qualified workers in country h

$\mu\left(\theta; \pi^h\right) =$ probability that worker with test θ is qualified

$$\mu\left(\theta; \pi^h\right) \equiv \frac{\pi^h \Pr(\theta| \text{ inv.})}{\pi^h \Pr(\theta| \text{ inv.}) + \left(1 - \pi^h\right) \Pr(\theta| \text{ no inv.})}$$

Convenient to Fix proportions of workers that invest in human capital π^h, π^f

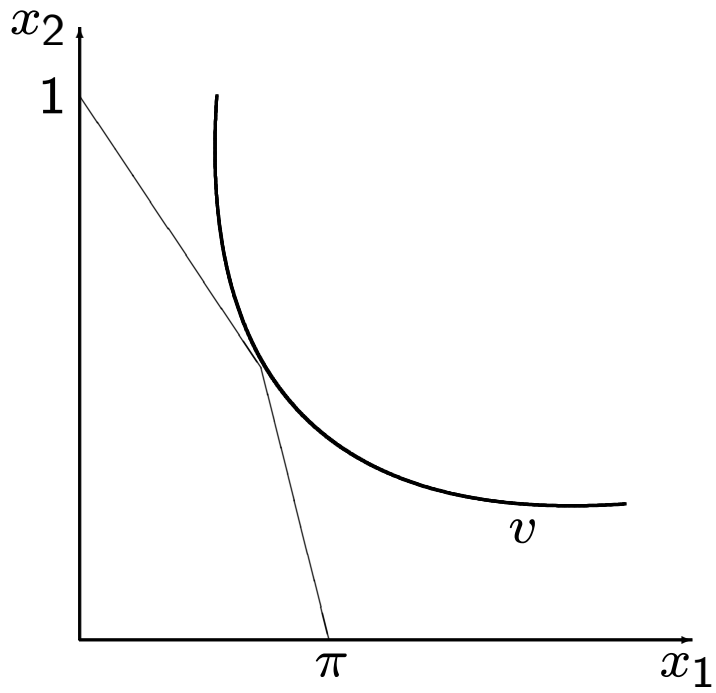
Equilibrium given Human Capital

$$w^h(\theta) = \begin{cases} 1 & \text{if } \theta \text{ is employed in sector 2} \\ p_1\left(\pi^h, \pi^f\right) \mu\left(\theta, \pi^h\right) & \text{otherwise} \end{cases}$$

Nature of the informational externalities: probability that worker with signal θ has invested:

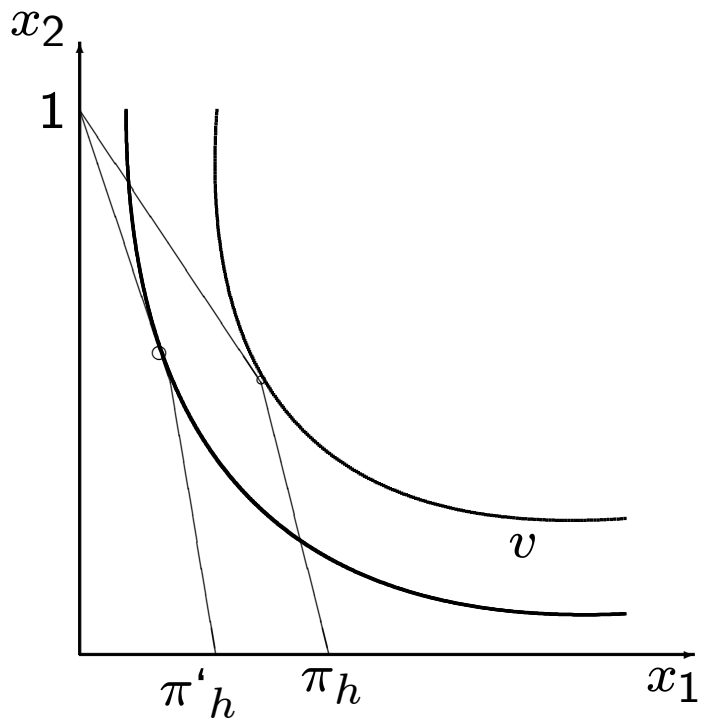
$$\mu\left(\theta; \pi^h\right) \equiv \frac{\pi^h \Pr(\theta| \text{ inv.})}{\pi^h \Pr(\theta| \text{ inv.}) + \left(1 - \pi^h\right) \Pr(\theta| \text{ no inv.})}$$

Fix π^h



$w_b = 1$

$w_g = p_1(\pi)\mu(g|\pi^h)$



Note: price of good 1 decreasing in π^h

Full equilibrium

wages: $w^h(\theta) = \begin{cases} 1 & \text{if } \theta \text{ is employed in sector 2} \\ p_1\left(\pi^h, \pi^f\right)\mu\left(\theta, \pi^h\right) & \text{otherwise} \end{cases}$

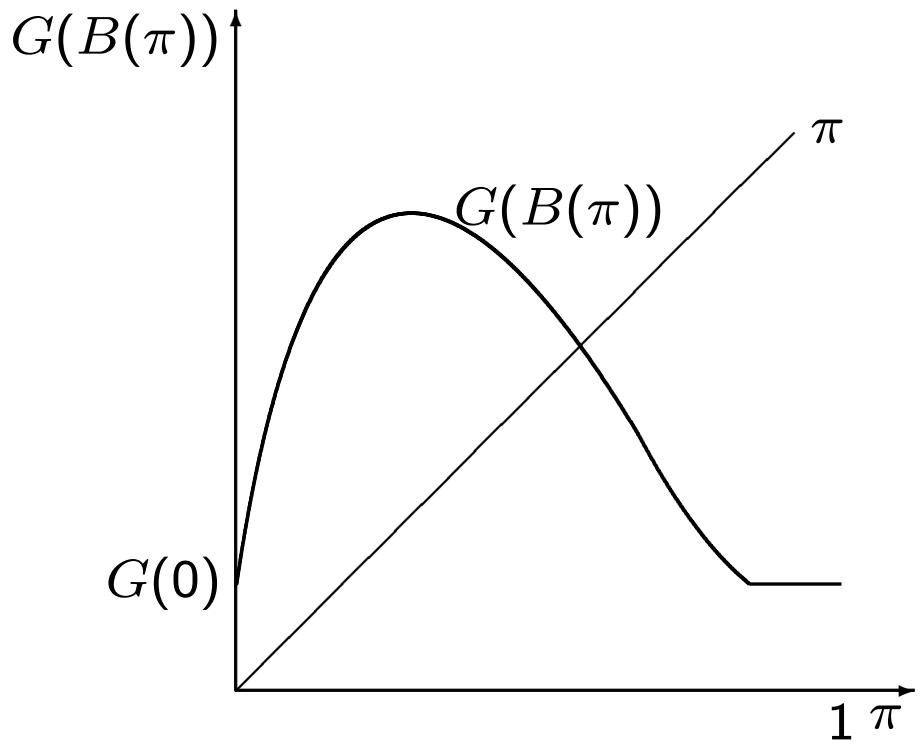
incentives:

$$B(\pi) = \underbrace{\sum_{\theta} v(w(\theta), p)\,\Pr(\theta|\text{inv})}_{\text{exp. utility if invest}} - \underbrace{\sum_{\theta} v(w(\theta), p)\,\Pr(\theta|\text{no inv})}_{\text{exp. utility if don't invest}}$$

Standard definition of competitive equilibrium, plus:

$$\begin{aligned} \pi^f &= G\left(B^f\left(\pi^f, \pi^h\right)\right) \\ \pi^h &= G\left(B^h\left(\pi^f, \pi^h\right)\right) \end{aligned}$$

G is the distribution over investment costs



Equilibrium fixed point in autarky: $\pi = G(B\,(\pi)$

$B(0) = 0; B(1) = 0$; $B(\pi)$ first increasing then decreasing

G is a c.d.f. (weakly increasing) that shifts function B.

Equilibrium:

- Given aggregate investment behavior π convexity everywhere $\Rightarrow$ uniqueness of consumption bundle, factor inputs, prices and wage schemes

- Start with π, determine the unique equilibrium given π, the wages scheme implies incentives to invest in human capital

- Small π : low signal-to-noise ratio - small wage differentials between workers with high and low θ - small incentives
As π increases...

- Possibility of multiple equilibria as "coordination failure"
(we do not focus on this)

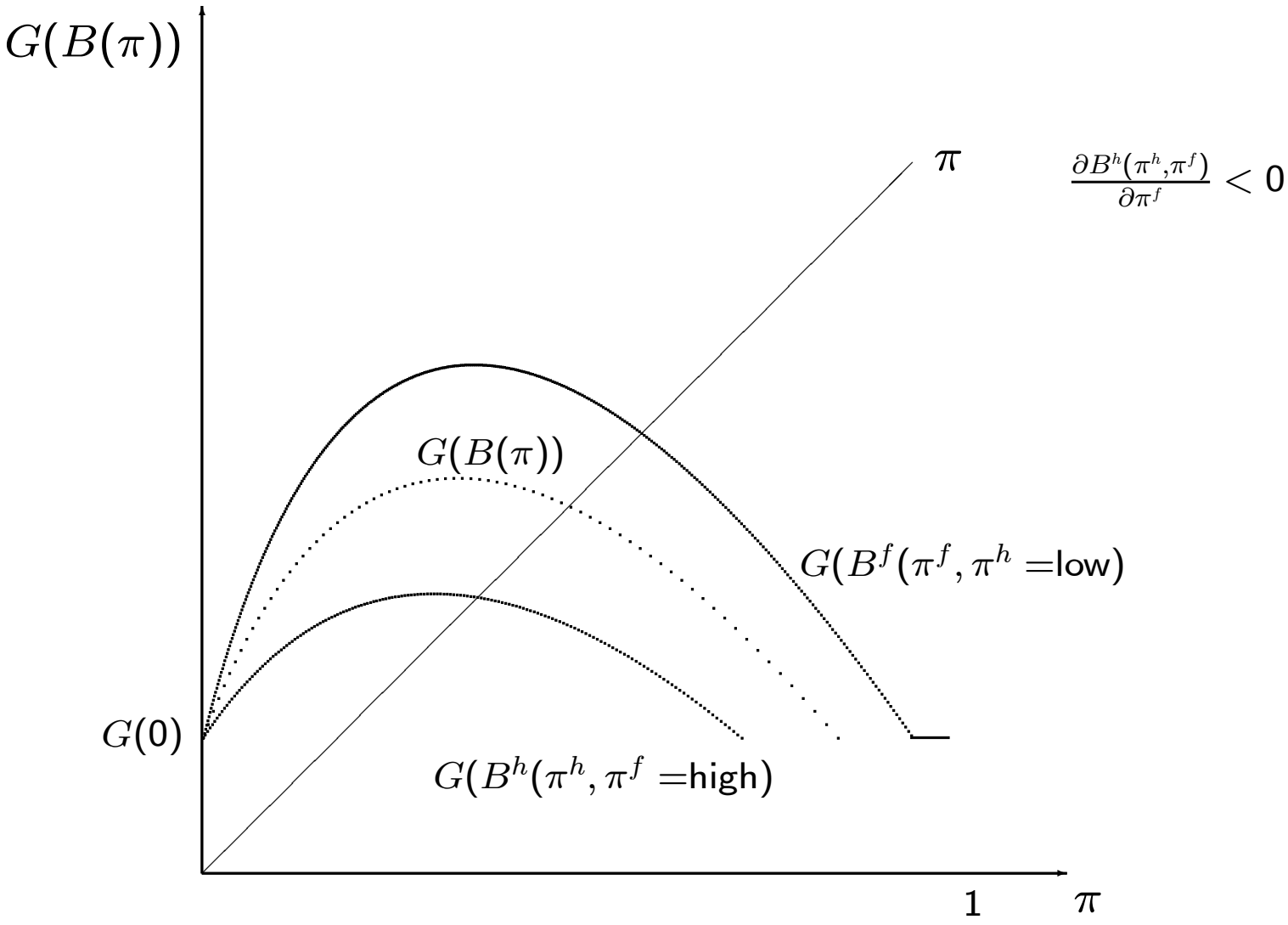
Possibility of equilibria with *specialization* even when there is a unique autarchic equilibrium.

Benefits at home as a function of investment abroad:

$$\frac{\partial B^h\left(\pi^h, \pi^f\right)}{\partial \pi^f} < 0$$

$\uparrow \pi^f \Rightarrow$ qualified labor increases $\Rightarrow$ produce larger quantity of the high tech good $\Rightarrow p_1 \downarrow$

$p_1 \downarrow \Rightarrow VMP$ of skilled workers $\downarrow \Rightarrow$ incentives $B_h \downarrow$


$G(B(\pi))$
π
$\frac{\partial B^h(\pi^h,\pi^f)}{\partial \pi^f} < 0$
$G(B(\pi))$
$G(B^f(\pi^f, \pi^h = \text{low})$
$G(0)$
$G(B^h(\pi^h, \pi^f = \text{high})$
1
π

Example 1: Autarky may make the poor country (h) better off

$\eta = \frac{2}{3}, \alpha = \frac{1}{2}$, $k \sim U[-0.02, 0.18]$	Trade, Country h	Trade, Country f	Autarky
Equilibrium Investment	$\pi^h = 0.1$	$\pi^f = 0.548$	$\pi = .269$
Production	$y_1^h = 0$ $y_2^h = 1$	$y_1^f = .463$ $y_2^f = .226$	$y_1 = 0.179$ $y_2 = .577$
Consumption	$x_1^h = .189$ $x_2^h = .5$	$x_1^f = .274$ $x_2^f = .726$	$x_1 = y_1$ $x_2 = y_2$
Gross incentives to invest	0	0.0897	0.0338
Gross expected utility	.307	.446	.321
Expected utility net of inv. cost	.308	.427	.319
Expected utility if invest	$.307 - k$	$.487 - k$	$.346 - k$
Expected utility if don't invest	.307	.397	.313
Prices	$p_1 = 2.648$ $w_g^h = w_b^h = 1$ $w_g^f = 1.875$ $E(w_f) = 1.452$		$p_1 = 3.216$ $w_b = 1$ $w_g = 1.364$ $E(w) = 1.154$

Example 2: Trade may be beneficial to both countries.

$\eta = \frac{2}{3}, \alpha = \frac{1}{2}$, $k \sim U[.04, .24]$	Trade, Country h	Trade, Country f	Autarky
Equilibrium Investment	$\pi^h = 0$	$\pi^f = 0.353$	$\pi = 0$
Production	$y_1^h = 0$ $y_2^h = 1$	$y_1^f = .284$ $y_2^f = .323$	$y_1 = 0$ $y_2 = 1$
Consumption	$x_1^h = .107$ $x_2^h = .5$	$x_1^f = .177$ $x_2^f = .823$	$x_1 = y_1$ $x_2 = y_2$
Gross incentives to invest	0	0.111	0
Gross average utility	.232	.381	$u = 0$
Avg. utility net of inv. cost	.232	.355	$u = 0$
Exp. utility if invest	$.232 - k$	$.452 - k$	$0 - k$
Exp. utility if don't invest	.232	.342	0
Prices	$p_1 = 4.660$ $w_g^h = w_b^h = 1$ $w_g^f = 2.433$ $E(w_f) = 1.647$		$p_1 = -$ $w_b = 1$ $w_g = -$ $E(w) = 1$

Informational asymmetry is crucial: if productivity is known, the scarcity argument would still hold, but the wage of an investor at home would be the same of the wage of an investor abroad $\Rightarrow$incentives to invest would be the same

Factors are paid expected marginal products, average wages are not the same across countries.
Here wage per expected ouput is the same, but workers with the same signal in different countries have different expected productivity because of the informational externality

Wage distribution conditional on observable skills more iniqual in rich countries

Is this a "bad" equilibrium?
Specialization reduces inefficiency from misallocation of workers in the wrong task