Effects of Globalization on Educational Choice and Unemployment under Search Friction

国際経済学会関西支部・中部支部合同研究会

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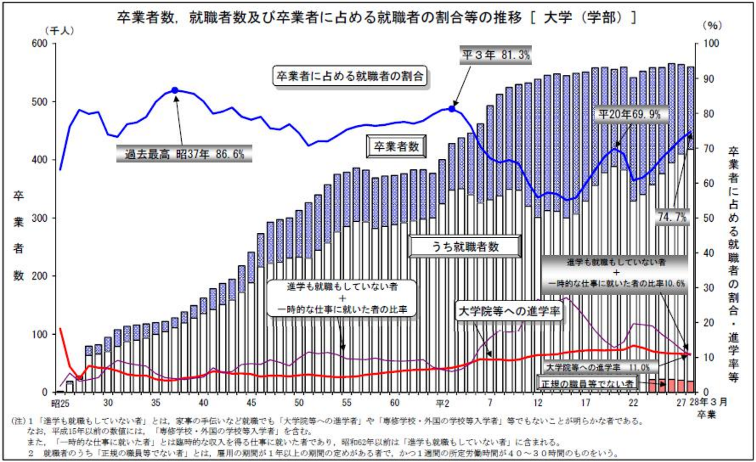
Introduction

- Unemploymen of the younger people is a big problem in developed countries.
- The US: the unemployment rate: 8% in 1955s $\rightarrow$ 13% in 2010s. (AP report, 2016)
- Korea: only about 60% of young people who graduated from universities are employed.
  - Han, H. (2016) Envious of Japanese young people whose employment markets have been opened widely = South Korea, Korean Joongang Daily translated by Japanese, Retrieved from November 22, 2016
- Japan: the employement rate of young people is 74.7% in 2016.

Introduction

- Higher education $\fallingdotseq$ The university enrollment rate $\uparrow$ (OECD report, 2012)
- The US: .45% in 1990 $\rightarrow$ 60%
- Korea: 45% in 1990 $\rightarrow$ 60%
- Japan: next slide.
- People may want to go to universities when the opportunities for getting employed are wide open.
- In reality, even when the employment rate is stagnant, the university enrollment rate continues to increase.
- There is an inconsistency between higher education and lower employment of university graduates.

Introduction



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Introduction (cont'd)

- Why has the university enrollment rate increased recently?
- One of reasons $\Rightarrow$ Globalization
  - Imports of foreign goods $\uparrow$
  - $\Rightarrow$ Local markets are more competitive.
  - $\Rightarrow$ Demand of skilled or high-educational labor $\uparrow$
- Potential workers may want to get higher education and higher skills.
- The increase in the number of skilled workers
  $\rightarrow$ a congestion in the skilled labor market
- Some skilled workers may remain to be unemployed.
- Focus on the inconsistency between higher education and higher unemployement.

Related literature: International trade with labor market

- Helpman and Itskhoki (2009), Helpman et al. (2010a,b), Egger and Kreickemeier (2009, 2012), and Ferlbermayr et al. (2010) and more...
- Labor search (Pissarides, 2000) & international trade (Melitz, 2003).
  1. Globalization increases the average productivity of the industry through the selection of low-productivity firms, which increases employment.
  2. since an increase in the average productivity means an increase in the effective firms, the rise in employment is not much greater than the increase in production. Consequently, the employment contracts.
- In their model, firm's quality and productivity are not directly depend on labor market.

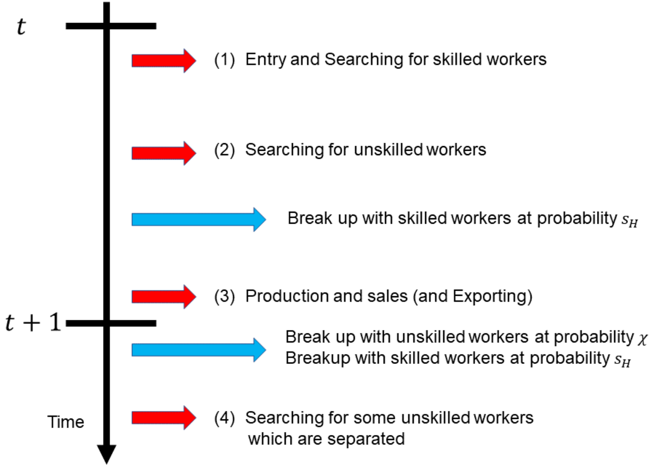
Related literature: Educational choice

- Furusawa et al. (2021): Firm's productivity is depends on the ability of the skilled workers.
- Falvey et al. (2010) and Danziger (2017):
    - Workers have heterogeneous ability but they do not realize their ability unless education.
    - Assuming full employment.
- Zenou (2008): Woker's choice on skill formation
    - Considering the unemployment of skilled workers and full employment of unskilled workers.
    - Only closed economy.

Structur of the model

- Goods: the differentiated goods produced under monopolistic competition.
- Factors: heterogeneous skilled workers and homogenous unskilled workers
  - A skilled worker is used to starting a business.
  - Unskiled workers are used for production.
- Labor market: existing search friction
  - Firms have to pay costs for searching these workers and matches workers with the probality.
  - After matching, the firm and the skilled worker negotiate the wage of the skilled worker.
  - The wage of the unskilled workers is competitively determined.
- Educational choice: each worker choose whether they take an education with compared between skilled and unskilled wages.
  - The ability of the worker is realized after educatiion.

Structure of the model



Preference

- CES Utility function:

$$u = \left[\int_{\omega\in\Omega} x(\omega)^{\frac{\sigma-1}{\sigma}} \mathrm{d}\omega\right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $x(\omega)$ denotes the consumption level of variety $\omega \in \Omega$ and $\sigma > 1$ denotes the elasticity of substitution.

- Demand function:

$$x(\omega) = \frac{p(\omega)^{-\sigma}}{P^{1-\sigma}}, \tag{2}$$

where $p(\omega)$ denotes the price of variety $\omega \in \Omega$ and P is the price index of the differentiated good as

$$P \equiv \left[\int_{\omega\in\Omega} p(\omega)^{1-\sigma} \mathrm{d}\omega\right]^{\frac{1}{1-\sigma}}. \tag{3}$$

Distributions of Potential and Realized Abilities

- There is a continuum of potential workers; the measure of them is denoted by N.
- Each worker has its own "potential educated ability" that makes it possible for the worker to serve as a skilled worker.
- The potential educated ability of a worker is realized only after the worker gets educated by incurring the cost of education.
- The potential educated abilities are distributed over the range of nonnegative reals: $\mathbb{R}_+$.
- The cumulative distribution function of the potential educated ability is $G\colon \mathbb{R}_+ \to [0,1]$.

Distributions of Potential and Realized Abilities (cont'd)

- $\underline{\alpha} > 0$: a lower boundary of the potential educated ability.
  - lower than $\underline{\alpha}$ $\rightarrow$ choosing not to be educated.
- The distribution function of the realized educated abilities:

$$F(\alpha) \equiv \begin{cases} \dfrac{G(\alpha) - G(\underline{\alpha})}{1 - G(\underline{\alpha})} & \text{if } \alpha \geq \underline{\alpha}, \\ 0 & \text{if } \alpha < \underline{\alpha}. \end{cases} \tag{4}$$

- The corresponding density function, denoted by $f\colon \mathbb{R}_+ \rightarrow \mathbb{R}_+$, is

$$f(\alpha) \equiv \begin{cases} \dfrac{g(\alpha)}{1 - G(\underline{\alpha})} & \text{if } \alpha \geq \underline{\alpha}, \\ 0 & \text{if } \alpha < \underline{\alpha}. \end{cases} \tag{5}$$

Matching Technology

- Both the skilled and unskilled labor markets are not perfect.
- We follow the framework of the search-matching labor market friction model developed by Pissarides (2000).
- Matching functions, through which firms and workers are matched randomly: for $i = H, L$,

$$M_i(u_i, v_i).$$

  - u_i is the measure of unemployment of the skilled or unskilled workers.
  - v_i is the total vacancy posted by the firms for skilled or unskilled workers.

- With $\theta_i \equiv v_i/u_i$ which is the ratio of the numbers of the unmatched firms and the unemployed workers, the above matching function is

$$m(\theta_L) \equiv \frac{M_L(v_L, u_L)}{v_L}. \tag{6}$$

Behavior of a Firm

- There is a huge pool of potential firms, which are homogeneous *ex ante*.
- When a firm enters the market, it has to hire one unit of skilled labor in order to develop its own differentiated variety.
- The ability of the skilled labor hired by a firm also determines the firm's productivity.
  $\rightarrow$ the firms in the market become heterogeneous *ex post*.
- To produce $x(\omega)$ units of the differentiated variety ω, the firm needs to employ $\ell = x(\omega)/\alpha$ units of unskilled workers.
- From Eq. (2), the total revenue accruing to the firm is

$$R(\ell, \alpha) \equiv [\ell \alpha P]^{\frac{\sigma-1}{\sigma}} . \quad (7)$$

Searching for unskilled workers

- In each period, the firm and the employed workers are hit by two independent idiosyncratic shocks:
  1. s_H: the probability that the matched pair of the firm and the skilled worker breaks up.
  2. χ is the probability that each job is destroyed because of some match-specific shocks
- The rate of job separation becomes $s_H + \chi - s_H\chi$.

Optimal vacancy posting

- In each period, taking the unskilled wage rate w_L as given, each firm decides the optimal number of vacancy posting.

$$J(\ell_t, \alpha) = \max_{k_t} \frac{1}{1+r} \left[R(\ell_t, \alpha) - w_L \ell_t - c_L k_t - w_H + (1 - s_H) J(\ell_{t+1}, \alpha) \right] \quad (8)$$
$$\text{s.t.} \quad \ell_{t+1} = (1 - \chi)\ell_t + m(\theta_L) k_t.$$

- The FOC for the maximization of the RHS of Eq. (8)

$$\frac{c_L}{m(\theta_L)} = (1 - s_H) \frac{\partial J(\ell_{t+1}, \alpha)}{\partial \ell}. \quad (9)$$

- With the Envelope Theorem,

$$\frac{\partial J(\ell_t, \alpha)}{\partial \ell} = \frac{1}{1+r} \left[\frac{\partial R(\ell_t, \alpha)}{\partial \ell} - w_L + (1 - \chi)(1 - s_H) \frac{\partial J(\ell_{t+1}, \alpha)}{\partial \ell} \right]. \quad (10)$$

Optimal vacancy posting (cont'd)

- In the steady state where $\ell_t = \ell_{t+1} = \ell$ for all t

$$\frac{\partial R(\ell, \alpha)}{\partial \ell} = w_L + \frac{(r + s_L)c_L}{(1 - s_H)m(\theta_L)}. \tag{11}$$

- Taking account of the definition of $R(\ell, \alpha)$, ℓ is solved as

$$\ell(\alpha) = \left(\frac{\sigma - 1}{\sigma}\right)^{\sigma} \left[w_L + \frac{(r + s_L)c_L}{(1 - s_H)m(\theta_L)}\right]^{-\sigma} P^{\sigma-1}\alpha^{\sigma-1}. \tag{12}$$

- $k(\alpha)$ becomes

$$k(\alpha) = \frac{\chi}{m(\theta_L)}\ell(\alpha). \tag{13}$$

Value of the firm

- Solving for $J(\ell(\alpha), \alpha)$, we obtain the value of the operating firm:

$$\hat{J}(\alpha, w_H) = \frac{1}{r + s_H}\left[R(\ell(\alpha), \alpha) - \left\{w_L + \frac{c_L \chi}{m(\theta_L)}\right\}\ell(\alpha) - w_H\right] \tag{14}$$

- The firms pay vacancy costs for simultaneously searching ℓ's unskilled workers and have wait one period to recruit their workers.
- In this period, they can be hit by a destruction shock, with probability s_H till starting production, so that they never start producing.
- The value od the entry firm:

$$\begin{aligned}\Pi(\alpha, w_H) &\equiv (1 - s_H)\hat{J}(\alpha, w_H) - \frac{c_L}{m(\theta_L)}\ell(\alpha) \\ &= \frac{1 - s_H}{r + s_H}\left[R(\ell(\alpha), \alpha) - w_L \ell(\alpha) - \frac{(r + s_L)c_L}{(1 - s_H)m(\theta)}\ell(\alpha) - w_H\right]\end{aligned} \tag{15}$$

Unskilled Labor Market Equilibrium

- Total demand for unskilled workers:

$$L_e \equiv Z \int_0^{+\infty} f(\alpha)\ell(\alpha)\mathrm{d}\alpha = Z\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}\left[w_L + \frac{(r+s_L)c_L}{(1-s_H)m(\theta)}\right]^{-\sigma} P^{\sigma-1}\tilde{\alpha}^{\sigma-1},$$

  where Z is the measure of firms operating in the market and $\tilde{\alpha}$ denotes the average productivity of the operating firms:

$$\tilde{\alpha} \equiv \left[\int_0^{+\infty} f(\alpha)\alpha^{\sigma-1}\mathrm{d}\alpha\right]^{\frac{1}{\sigma-1}} \equiv \left[\frac{1}{1-G(\underline{\alpha})}\int_{\underline{\alpha}}^{+\infty} g(\alpha)\alpha^{\sigma-1}\mathrm{d}\alpha\right]^{\frac{1}{\sigma-1}}. \tag{16}$$

- Suppose that $\theta_L m(\theta_L)L$ is the number of successful (i.e., matched) unskilled workers, we can solve the wage of the unskilled workers from $L_e = \theta_L m(\theta_L)L$ in equilibrium:

$$w_L = \left(\frac{\sigma-1}{\sigma}\right)\left[\frac{Z}{\theta_L m(\theta_L)L}\right]^{\frac{1}{\sigma}} P^{\frac{\sigma-1}{\sigma}}\tilde{\alpha}^{\frac{\sigma-1}{\sigma}} - \frac{(r+s_L)c_L}{(1-s_H)m(\theta_L)}. \tag{17}$$

Unskilled Labor Market Equilibrium

- Using Eq. (17) and (12), the value of the entry firm is calculated as

$$\Pi(\alpha, w_H) = \frac{1-s_H}{r+s_H}\left[\frac{1}{\sigma}\left\{\frac{\theta_L m(\theta_L) LP}{Z\tilde{\alpha}^{\sigma-1}}\right\}^{\frac{\sigma-1}{\sigma}}\alpha^{\sigma-1} - w_H\right] \quad (18)$$
$$= \frac{1-s_H}{r+s_H}\left[\pi(\alpha) - w_H\right].$$

- The total vacancy for unskilled workers:

$$v_L = Z\int_0^{+\infty} f(\alpha)k(\alpha)\mathrm{d}\alpha = \chi\theta_L L$$

- Since the unemployment of the unskilled worker is $u_L = s_L L/[\theta_L m(\theta_L) + s_L]$, θ_L becomes

$$\theta_L \equiv \frac{v_L}{u_L} = \frac{\chi\theta_L L}{\left(\dfrac{s_L L}{\theta_L m(\theta_L) + s_L}\right)} \quad \Leftrightarrow \quad \theta_L m(\theta_L) = \frac{1-\chi}{\chi}\cdot s_L \quad (19)$$

Searching for skilled workers

- Before entering the differentiated good market, each potential firm has to hire a skilled worker to develop its own differentiated variety.
- The potential firm has to pay a search cost to post a vacancy for a skilled worker.
- Once a firm and a skilled worker have been matched through the matching mechanizm at the skilled labor market, they negotiate on the wage rate for the skilled worker.
- We adopt the framework of a generalized Nash bargaining to examine the negotiation between the matched pair of a firm and a skilled worker.

Bargaining

- The skilled worker's benefit is

$$rW_H = w_H - s_H[W_H - U_H], \tag{20}$$

where U_H is the value of remaining to be unemployed and s_H idiosyncratic shocks with the probability.

- The Nash bargaining over the skilled wage rate is described by the following maximization problem of the generalized Nash product:

$$\max_{w_H} [W_H - U_H]^{\beta} [\Pi(\alpha, w_H)]^{1-\beta}, \tag{21}$$

where β $(0 < \beta < 1)$ represents the relative bargaining power of the skilled worker.

- F.O.C.

$$\beta[\pi(\alpha) - w_H] = (1 - \beta)[w_H - rU_H]. \tag{22}$$

Entry of the firm

- The value of the vacancy:

$$rV = -c_H + n(\theta_H)[1 - G(\alpha^*)][\Pi - V]. \tag{23}$$

- Free entry in the supply of vacancies implies $V = 0$. In the steady state, we have

$$\Pi = \frac{c_H}{n(\theta_H)[1 - G(\alpha^*)]} \tag{24}$$

- The value of unemployment, U_H, satisfies

$$rU_H = b + \theta_H n(\theta_H)[W_H - U_H]. \tag{25}$$

where b is an unemployment insurance.

- The reservation wage becomes

$$rU_H = b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1 - G(\alpha^*)]} \tag{26}$$

- Substituting Eq. (26) into Eq. (22), we obtain the Wage Determination equation:

$$w_H(\alpha) = b + \beta\left[\pi(\alpha) - b + \frac{c_H\theta_H}{(1-s_H)[1-G(\alpha^*)]}\right] \tag{27}$$

- Combining Eq. (18), Eq. (24) and Eq. (27), we obtain the Job Creation equation:

$$\frac{1-s_H}{r+s_H}[\pi(\alpha) - w_H(\alpha)] = \frac{c_H}{n(\theta_H)[1-G(\alpha^*)]} \tag{28}$$

Product Market Equilibrium

- α^* is the cutoff productivity such that $\Pi(\alpha^*_D) = 0$:

$$\pi(\alpha^*) = \frac{1}{\sigma}\left[\frac{\theta_L m(\theta_L) LP}{Z\tilde{\alpha}^{\sigma-1}}\right]^{\frac{\sigma-1}{\sigma}} (\alpha^*)^{\sigma-1} = w_H(\alpha^*) \tag{29}$$

- The wage of the skilled worker with α^* is

$$w_H(\alpha^*) = b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha^*)]} \tag{30}$$

- ZCP condition and free entry condition gives a condition which describes the relationship between α^* and θ_H:

$$\begin{aligned} &\frac{(1-\beta)(1-s_H)}{r+s_H}\left\{b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha^*)]}\right\} \\ &\times \left[\left(\frac{\tilde{\alpha}}{\alpha^*}\right)^{\sigma-1} - 1\right] = \frac{c_H}{n(\theta_H)} \end{aligned} \tag{31}$$

Product Market Equilibrium (cont'd)

- In equilibrium, total expenditure on the differentiated good equals total revenues of all firms serving the demand in this sector.
- Note the total expenditure on the differentiated good is an *numéraire* and that there are operation firms with the skilled worker whose ability over α^*, the expenditure condition is

$$\int_{\alpha^*}^{+\infty} p(\alpha)x(\alpha)\frac{g(\alpha)}{1-G(\alpha^*)}\mathrm{d}\alpha = 1$$

- sing the demand function of the differentiated goods in Eq. (2) and the optimal firm size in Eq. (11), we obtain another relationship euqation between α^* and θ_H:

$$\int_{\alpha^*}^{+\infty} \alpha^{\sigma-1}\frac{g(\alpha)}{1-G(\alpha^*)}\mathrm{d}\alpha \left\{\frac{\theta_L m(\theta_L)LP}{Z}\right\}^{\frac{\sigma-1}{\sigma}} \tilde{\alpha}^{-\frac{(\sigma-1)^2}{\sigma}} = 1 \quad (32)$$

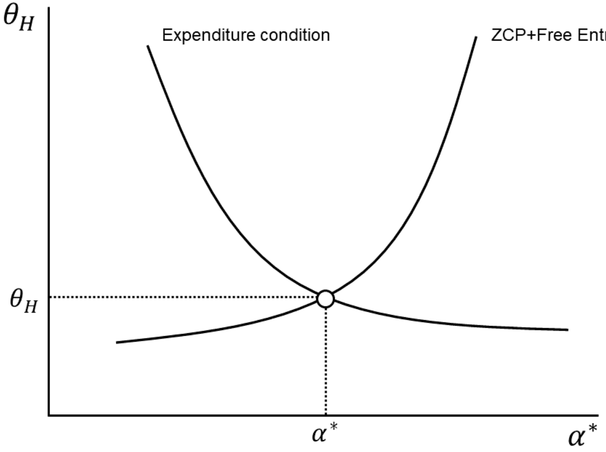
Product Market Equilibrium (cont'd)

- We assume that workers' abilities are distributed according to a Pareto distribution
- Setting the scale parameter of that distribution to unity, the probability density is $g(\alpha) = \gamma \alpha^{-(1+\gamma)}$.
- Using this Pareto distribution, Eq. (31) and Eq. (32) are modified as

$$\frac{(1-\beta)(1-s_H)}{r+s_H} \left\{ b \left(\frac{1}{\alpha^*} \right)^{\gamma} + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)} \right\} \left\{ \left(\frac{\tilde{\alpha}}{\alpha^*} \right)^{\sigma-1} - 1 \right\} = \frac{c_H}{n(\theta_H)} \quad (33)$$

$$b + \frac{\beta c_H \theta_H \{\alpha^*\}^{\gamma}}{(1-\beta)(1-s_H)} = \frac{\gamma - (\sigma - 1)}{\sigma \gamma} \quad (34)$$

Structure of the model



Educational Choice

- A worker with ability α determine whether to get an education at the beginning of the term.
- When unskilled workers pursue an education with education cost, e, they can realize their ability and become skilled workers.
- The wage of the skilled worker with ability α, $w_H(\alpha^*)$:

$$w_H(\alpha) = \left\{\beta\left(\frac{\alpha}{\alpha^*}\right)^{\sigma-1} + 1 - \beta\right\}\left[b + \frac{\beta c_H \theta_H (\alpha^*)^\gamma}{(1-\beta)(1-s_H)}\right] - e$$

- The wage of unskilled worker, w_L:

$$w_L = \frac{\gamma(\sigma-1)\chi}{\{\gamma-(\sigma-1)\}(1-\chi)s_L}\left\{\frac{\theta_H n(\theta_H)}{\theta_H n(\theta_H)+s_H}\right\}\frac{\underline{\alpha}^{-\gamma+\sigma-1}\{\alpha^*\}^{-(\sigma-1)}}{1-\underline{\alpha}^{-\gamma}} \times\left\{b + \frac{\beta c_H \theta_H (\alpha_D^*)^\gamma}{(1-\beta)(1-s_H)}\right\} - \frac{(r+s_L)c_L}{(1-s_H)m(\theta_L)}$$

Educational Choice (cont'd)

- If the wage of the worker with α in the skilled labor market, which detects educational cost, is higher than that of the unskilled labor market, $w_H(\alpha) - e > w_L$, the worker shift to the skilled labor pool from the unskilled labor market.
- On the other hand, if the wage earned by the skilled labor market is lower that of the unskilled labor market, $w_H(\alpha) - e < w_L$, the worker remain in the unskilled labor market.
- In equilibrium, there is an educational cutoff ability $\underline{\alpha}$, where the expected wage rate for unskilled worker, w_L, has to be equal with the expected income of skilled worker $w_H(\underline{\alpha}) - e$.
- Therefore, the education cutoff, $\underline{\alpha}$ is determined in the following equation:

$$w(\underline{\alpha}) - e = w_L \tag{35}$$

- Since w_L is decreasing in $\underline{\alpha}$ and $w_H(\underline{\alpha})$ is increasing in $\underline{\alpha}$, there exists an equilibrium educational cutoff, $\underline{\alpha}$.

Open Economy

- We investigate the effect of globalization on a worker's job choice and the the number of unemployment of a country.
- There are two symmetric countries with the same preferences, production technology, number of workers, and characteristics of the labor market.
- We assume that the systems of the labor market are independent from each other.
- Suppose that the firms face fixed market access cost $f > 0$ if they start exporting, and that it costs an ice-berg type tariff, $\tau \geq 1$, to exporting goods.
- We denote the index of $X, \ D$ as exporting and domestic sales.

Open Economy (cont'd)

- The optimal employment of unskilled workers for exporting sales:

$$\ell_X = \tau^{\sigma-1}\ell_D = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} A^{-\sigma} P^{\sigma-1} \alpha^{\sigma-1} \tau^{1-\sigma}$$

- The potential firms, which have not matched any workers yet, consider the expected value of operating both domestic and exporting.
- Therefore, the wage of the unskilled workers:

$$w_L = \left(\frac{\sigma-1}{\sigma}\right)\left[\frac{Z}{\theta_L m(\theta_L) L}\right]^{\frac{1}{\sigma}} P^{\frac{\sigma-1}{\sigma}} \tilde{\alpha}^{\frac{\sigma-1}{\sigma}} (1+\tau^{1-\sigma}) - \frac{(r+s_L)c_L}{(1-s_H)m(\theta_L)}. \tag{36}$$

- $\pi(\alpha)$ becomes

$$\pi_D(\alpha) = \frac{1}{\sigma}\left(\frac{\theta_L m(\theta_L) L P}{Z\tilde{\alpha}^{\sigma-1}}\right)^{\frac{\sigma-1}{\sigma}} \alpha^{\sigma-1},$$

$$\pi_X(\alpha) = \frac{1}{\sigma}\left(\frac{\theta_L m(\theta_L) L P}{Z\tilde{\alpha}^{\sigma-1}}\right)^{\frac{\sigma-1}{\sigma}} \alpha^{\sigma-1}\tau^{1-\sigma}.$$

Skilled Labor Market in Open Economy

- The structure of skilled labor market is also the same in closed economy.
- Given firm's revenues are increasing in α, there exists a threshold α_D^* below which firms do not take up production.
- Similarly, firms with a productivity level between α_D^* and α_X^* will serve only their domestic market.
- The firms calculate their actual profit after recognizing α, and decide whether their activity policy: exit, only domestic sale, or both domestic and exporting sales.
- The firms negotiate w_H with the skilled worker, and the wage schedule becomes the same one in Eq. (27).

Product Market Equilibrium in Open Economy

- At a threshold of α_D^*, the value of firms which only sell their variety in domestic market go to zero, $\Pi(\alpha_D^*, w_H) = 0$:

$$\pi_D(\alpha_D^*) = \frac{1}{\sigma}\left(\frac{\theta_L m(\theta_L) L P}{Z\tilde{\alpha}^{\sigma-1}}\right)^{\frac{\sigma-1}{\sigma}} (\alpha_X^*)^{\sigma-1} = w_H(\alpha_D^*) \tag{37}$$

- On the other hand, the profit of exporting sales is zero at the threshold of α_X^*, and we obtain $\pi_X(\alpha_X^*) - f = 0$.
- the condition for α_D^* and α_X^*:

$$\begin{aligned}\tau^{1-\sigma}\left(\frac{\alpha_X^*}{\alpha_D^*}\right) &= \frac{f}{w_H(\alpha_D^*)} \\ &= f \cdot \left\{b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha_D^*)]}\right\}^{-1}\end{aligned} \tag{38}$$

- Given α_D^*, Eq. (38) determines α_X^*. To guarantee $\alpha_X^* > \alpha_D^*$, we assume

$$\tau^{\sigma-1} f > b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha_D^*)]}.$$

Product Market Equilibrium in Open Economy (cont'd)

- The first condition which describes the relationship between α_D^* and θ_H.

$$\left\{\left(\frac{\tilde{\alpha}}{\alpha_D^*}\right)^{\sigma-1} + (1-\beta)\left(\frac{\tilde{\alpha}}{\alpha_X^*}\right)^{\sigma-1} - 1\right\}\left\{b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha_D^*)]}\right\} + f\left\{\beta\tau^{\sigma-1}\left(\frac{\tilde{\alpha}}{\alpha_X^*}\right)^{\sigma-1} - 1\right\} = \frac{(r+s_H)c_H}{(1-\beta)(1-s_H)[1-G(\alpha_D^*)]n(\theta_H)} \quad (39)$$

- In equilibrium, total expenditure on the differentiated good equals total revenues of all firms serving the demand in this sector.

$$\left\{b + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)[1-G(\alpha_D^*)]}\right\} \times \sigma\left[\left(\frac{1}{\alpha_D^*}\right)^{\sigma-1}\int_{\alpha_D^*}\alpha^{\sigma-1}\frac{g(\alpha)}{1-G(\alpha_D^*)} + \left(\frac{1}{\tau\alpha_D^*}\right)^{\sigma-1}\int_{\alpha_X^*}\alpha^{\sigma-1}\frac{g(\alpha)}{1-G(\alpha_X^*)}\right] = 1 \quad (40)$$

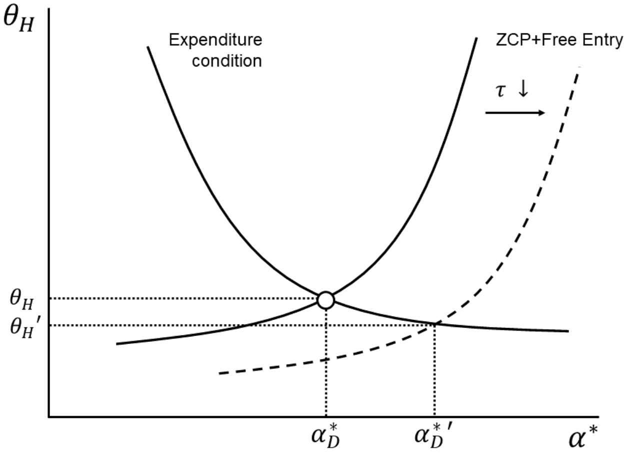
Product Market Equilibrium in Open Economy (cont'd)

- For given $\underline{\alpha}$, conditions in Eq. (38), (39), and (40) allow to solve α_D^*, α_X^*, and θ_H.
- By symmetry, the three conditions together allow to solve for the cutoffs and demand levels simultaneously.
- To clarify the later discussion, we assume that the workers' ability follows the Pareto distribution, so that Eq. (39) and Eq. (40) become

$$\left\{\left(\frac{\tilde{\alpha}}{\alpha_D^*}\right)^{\sigma-1} + (1-\beta)\left(\frac{\tilde{\alpha}}{\alpha_X^*}\right)^{\sigma-1} - 1\right\}\left\{b\left(\frac{1}{\alpha_D^*}\right)^{-\gamma} + \frac{\beta c_H \theta_H}{(1-\beta)(1-s_H)}\right\} + f\left(\frac{1}{\alpha_D^*}\right)^{-\gamma}\left\{\beta\tau^{\sigma-1}\left(\frac{\tilde{\alpha}}{\alpha_X^*}\right)^{\sigma-1} - 1\right\} = \frac{(r+s_H)c_H}{(1-\beta)(1-s_H)n(\theta_H)} \quad (41)$$

$$b + \frac{\beta c_H \theta_H (\alpha_D^*)^\gamma}{(1-\beta)(1-s_H)} + f = \frac{\gamma - (\sigma-1)}{\gamma\sigma} \quad (42)$$

Trade Liberalization



Effect of a reduction of τ on α^* and θ_H

Effects of trade liberalization on educational choice

- The wage of the unskilled workers:

$$w_L = \frac{\gamma(\sigma-1)\chi}{\{\gamma-(\sigma-1)\}(1-\chi)s_L}\left\{\frac{\theta_H n(\theta_H)}{\theta_H n(\theta_H)+s_H}\right\}\frac{\underline{\alpha}^{-\gamma+\sigma-1}\{\alpha^*\}^{-(\sigma-1)}}{1-\underline{\alpha}^{-\gamma}}$$
$$\times\left\{b+\frac{\beta c_H\theta_H(\alpha_D^*)^\gamma}{(1-\beta)(1-s_H)}\right\}(1+\tau^{\sigma-1})-\frac{(r+s_L)c_L}{(1-s_H)m(\theta_L)}.$$

- The wage of the skilled workers:

$$w_H(\alpha) = \beta[\pi_D(\alpha)+\pi_X(\alpha)-f]+(1-\beta)+\frac{\beta c_H\theta_H}{1-G(\alpha_D^*)}$$
$$=\left\{(\beta+\tau^{1-\sigma})\left(\frac{\alpha}{\alpha_D^*}\right)^{\sigma-1}+1-\beta\right\}\left\{b+\frac{\beta c_H\theta_H(\alpha_X^*)^\gamma}{(1-\beta)(1-s_H)}\right\}-f,$$

Effects of trade liberalization on educational choice (cont'd)

- Trade liberalization affects the determination of θ_H and α^*_D in Eq. (41) and Eq. (42), and also changes the educational cutoff, $\underline{\alpha}$, thorough the comparison of w_H and w_L.
- We define an implicit function, $E(\alpha^*, \theta_H, \underline{\alpha}, \tau) \equiv w_H(\underline{\alpha}) - e - w_L = 0$.
- $\underline{\alpha}$ is solved by educational condition and can be expressed as a function of τ, so that the implicit function can be modified $E(\alpha^*_D(\underline{\alpha}, \tau), \theta_H(\underline{\alpha}, \tau), \underline{\alpha}(\tau), \tau)$.
- By implicit function theory, the effect of decreasing τ on the education cutoff is

$$\frac{\partial \alpha}{\partial \tau} = -\frac{\frac{\partial E}{\partial \alpha^*}\frac{\partial \alpha^*_D}{\partial \tau} + \frac{\partial E}{\partial \theta_H}\frac{\partial \theta_H}{\partial \tau} + \frac{\partial E}{\partial \tau}}{\frac{\partial E}{\partial \alpha^*_D}\frac{\partial \alpha^*_D}{\partial \underline{\alpha}} + \frac{\partial E}{\partial \theta_H}\frac{\partial \theta_H}{\partial \underline{\alpha}} + \frac{\partial E}{\partial \underline{\alpha}}}.$$

Effects of trade liberalization on educational choice

- Note that $\partial\alpha_D^*/\partial\tau < 0$, $\partial\theta_H/\partial\tau > 0$, $\partial\alpha_D^*/\partial\underline{\alpha} < 0$ and $\partial\theta_H/\partial\underline{\alpha} < 0$ $\partial\alpha_D^*/\partial\underline{\alpha} > 0$.
- Deceasing in τ gives an ambiguous effect on the education cutoff, $\underline{\alpha}$.
- If the sign of the above equation is positive, trade liberalization decreases the education cutoff, and the production cutoff, α_D^*, also increases from (41) and Eq. (42).
- The expand of the range between $\underline{\alpha}$ and α_D^* means that the skilled workers with low ability are easy to become unemployment while the number of the skilled workers increase.
- This model cannot solve the total effects on the unemployment analytically. However, we show the possibility that globalization may increase the number of unemployment.

Conclusion

- This article analyzes the effects of globalization on the worker' choice of jobs and employment. We assume that search friction exists in the skilled and unskilled labor market and that workers can choose to be skilled or unskilled worker.
- If a firm succeeds in matching with a skilled worker, it can start a business and the productivity of the firm depends on the ability whose matched-skilled worker has.
- Trade liberalization among two symmetry countries increases the profit of the operating firms, which raises the entry of firms and the demand for skilled workers.
- These effects attract both skilled and unskilled workers.
- We obtain ambiguous effects of globalization on the worker's education choice.
- However, we find a possibility where the globalization promotes the popularization of high education and the unemployment of skilled workers.

Thank you for your attention.