New Trade Theory without the Agricultural Sector

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- Zeng, D.-Z. and Uchikawa, T. (2012): The Home Market Effect in a Multicountry Space. http://ssrn.com/abstract=2056129.
- Tan, L. and Zeng, D.-Z. (2012): Developing and Developed Economies: a Synthesis of First and Second Natures. http://ssrn.com/abstract=2056181
- Zhou, Y. and Zeng, D.-Z. (2012): Offshoring, Globalization and Welfare. http://ssrn.com/abstract=2056214

New trade theory (NTT)

- First nature Ricardian and H-O comparative advantage
  $\Rightarrow$ inter-industry trade
- Leontief paradox, Intraindustry trade
- Second nature The role of IRS
- The Home Market Effect (HME)
  - A country with a relatively larger local demand attracts a more-than-proportionate share of manufacturing firms
  - The wage is higher in a larger country
  - The large country is a net exporter of manufactured goods
- Under CRS, no HME

The agricultural good

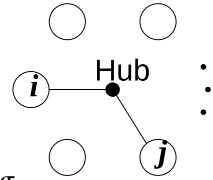
- Two basic assumptions
  - two countries/regions
  - the existence of an agricultural good: homogeneous and freely traded
- Agricultural good: equalizing labor wages
  - simplifies model very much
  - an outside good
  - wages are not equalized across countries in the real world
- This presentation: NTT without the agricultural good
  - the HME in a multicountry space
  - endogenous offshoring
  - wage inequalities among developing and developed countries

The HME in a multicountry space

- There are some papers on the core-periphery model in a multiregion space
- Behrens, Lamorgese, Ottaviano, and Tabuchi (2009): the HME in a multicountry world with the freely traded agricultural good
  - prove the existence of HME in terms of firm share when there are no geographical advantage and technical advantage among countries
  - no information about wage

The model

- n countries are different only in population size
  - total population L, total capital K
  - Each worker owns 1 labor + K/L capital
  - Population shares: $\theta_1 \geq \theta_2 \geq \cdots \geq \theta_n$
- Only one sector: manufacturing goods
  - Utility function $U_i = \left[\int_0^N d_i(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}}$
  - Behrens and Murata (2007): multiplicatively quasi-separable function
  - Fixed: 1 capital, Marginal: $(\sigma-1)/\sigma$ labor
  - Trade cost $\tau_{ij} = \begin{cases} \tau & \text{if } i \neq j \\ 1 & \text{if } i = j \end{cases}, \quad \phi_{ij} = \tau_{ij}^{1-\sigma}$



- Exclude first-nature features

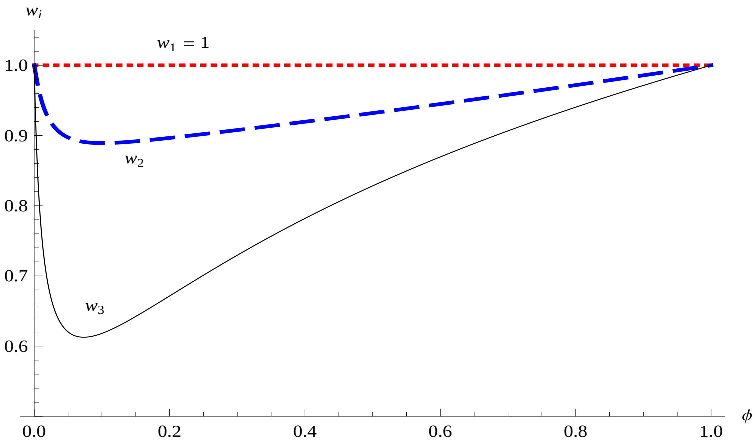
Equilibrium

- Numéraire: labor in country 1. Wages: $w_1, w_2, \cdots, w_n$
- Firm shares $k_i = \dfrac{w_i\theta_i}{\sum_{j=1}^n \theta_j w_j}$
- w_i are determined by $(i = 1, 2, \cdots, n)$

$$1 - w_i^{1-\sigma} \sum_{j=1}^{n} \frac{\frac{\sigma - 1}{\sigma} w_j + \frac{1}{\sigma} \sum_{k=1}^{n} \theta_k w_k}{(1-\phi) w_j^{2-\sigma} + \phi \sum_{k=1}^{n} \frac{\theta_k}{\theta_j} w_k^{2-\sigma}} \phi_{ij} = 0 \qquad (1)$$

- We cannot obtain a analytical solution for w_i

A simulation result



Equilibrium: some findings

- The equivalence of two HME definitions
  - $\frac{k_1}{\theta_1} \geq \frac{k_2}{\theta_2} \geq \cdots \geq \frac{k_n}{\theta_n}$
  - $w_1 \geq w_2 \geq \cdots \geq w_n$
- The existence of the HME
  - to show that (1) has a solution in $[\phi^{\frac{1}{\sigma-1}}, 1]^n$
    - Fixed point theorem
    - How to find the mapping? My student gave up.
    - to show that $1 \geq w_2 \geq \cdots \geq w_n$
- U-shape of wages

Mapping

- Rewrite (1) as $1 - w_i^{1-\sigma} \sum_{j=1}^{n} H_j(w,\phi)\phi_{ij} = 0$ where

$$H_j(w,\phi) \equiv \frac{\frac{\sigma-1}{\sigma} w_j + \frac{1}{\sigma}\sum_{k=1}^{n} \theta_k w_k}{(1-\phi) w_j^{2-\sigma} + \phi \sum_{k=1}^{n} \frac{\theta_k}{\theta_j} w_k^{2-\sigma}}, \text{ for } w \in (0,\infty)^n$$

- Fixed point of mapping $\mathcal{M}(w,\phi) = w$, where

$$\mathcal{M}_i(w,\phi) = \begin{cases} \{(1-\phi)[H_i(w,\phi) - H_1(w,\phi)] + 1\}^{\frac{1}{\sigma-1}}, & \text{if } \sigma \geq 2 \\ w_i^{2-\sigma}\{(1-\phi)[H_i(w,\phi) - H_1(w,\phi)] + 1\}, & \text{if } \sigma \in (1,2) \end{cases}$$

Mapping (cont.)

- $w_{-1} = (w_2, \cdots, w_n) \in (0, \infty)^{n-1}$, $w = (1, w_{-1})$
- $\mathcal{M}_1(w, \phi) = 1$, $\mathcal{M}_{-1}(w, \phi) = (\mathcal{M}_2, \cdots, \mathcal{M}_n)$ maps $(0, \infty)^{n-1}$ to $(0, \infty)^{n-1}$
- $\mathcal{M}_{-1}(w, \phi)$ maps $[\phi^{\frac{1}{\sigma-1}}, 1]^{n-1}$ to $[\phi^{\frac{1}{\sigma-1}}, 1]^{n-1}$
  - $H_1(w) \leq 1$ for $w_{-1} \in [\phi^{\frac{1}{\sigma-1}}, 1]^{n-1}$
  - $H_i(w, \phi) \leq H_1(w, \phi)$ when $\sigma \geq 2$ and $(1 - \phi)[H_i(w, \phi) - H_1(w, \phi)] + 1 \leq w_i^{\sigma-1}$ when $\sigma \in (1, 2)$
- Theorem 1 For any $\sigma \in (1, \infty)$, there exist equilibrium wage rates $w(\phi)$ with $w_j(\phi) \in [\phi^{\frac{1}{\sigma-1}}, 1]$.
- Theorem 3 $1 = w_1 > w_2 > \cdots > w_n$ if $\theta_1 > \theta_2 > \cdots > \theta_n$
  - Curves $w_i(\phi)$ cross at $(0, 1)$ and $(1, 1)$ for $\phi \in [0, 1]$
  - By implicit function theorem, $w_j'(0) = \sigma\left(\frac{1}{\theta_1} - \frac{1}{\theta_j}\right)$ so $w_1'(0) > w_2'(0) > \cdots > w_n'(0)$

U-shaped wage curves

- Theorem 4 If $\theta_1 > \theta_2 > \cdots > \theta_n$, the relative wage w_i/w_j for any two countries $i > j$ evolves as a U-shaped curve with respect to ϕ.
  - equation $\mathcal{M}_i(w, \phi) = w_i$ can be rewritten as a quadratic function of ϕ
  - Only possible forms of $w_i(\phi)$ are: (i) increasing for all $\phi \in (0, 1)$; (ii) decreasing for all $\phi \in (0, 1)$; (iii) an inverted-U-shaped curve; (iv) a U-shaped curve.
  - Only (iv) is possible because

$$w_i'(1) = \frac{\theta_1 - \theta_i}{\sigma - 1} > 0, \quad w_i'(0) = \sigma\left(\frac{1}{\theta_1} - \frac{1}{\theta_j}\right) < 0.$$

U-shaped wage curves (cont.)

- Economics inside
  - A higher concentration of firms within a country increases wages there, giving two opposite forces.
    - final demand increases because of consumers' higher incomes, which encourages more agglomeration of firms;
    - the higher wage rate increases the labor costs of firms there, which is a dispersion force discouraging agglomeration
  - The dispersion force is large when ϕ is large and the agglomeration force is small when ϕ is small, resulting the U shape of wage rates.

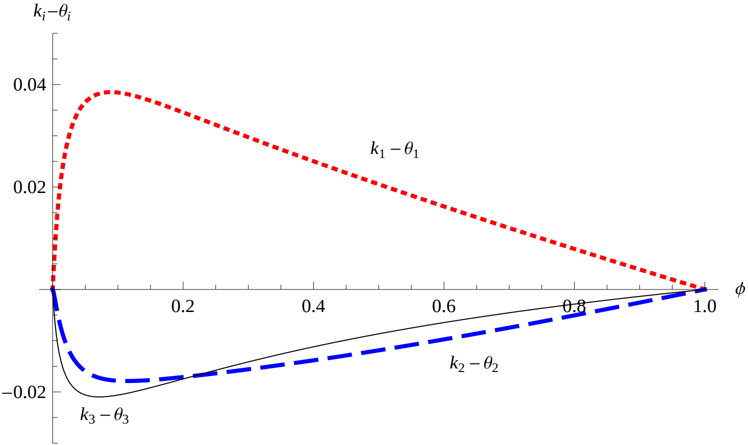
HME in terms of trade pattern

- Trade balance: trade surplus of manufactured goods in each country is equal to the net flow of capital rent
- A larger country exports M more than a smaller country iff

$$k_i - \theta_i \geq k_{i+1} - \theta_{i+1}, \quad \text{for} \quad i = 1, \cdots, n-1.$$

- Not always true: a simulation example
- Among 3 definitions, wage order seems to be empirical appeal. Simplest to be tested.

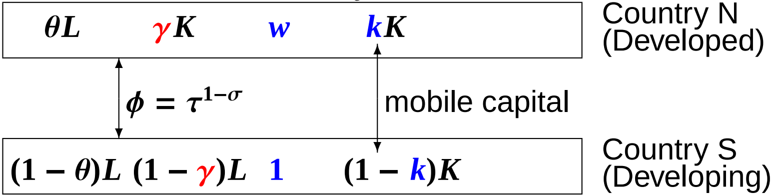
HME in terms of trade pattern (cont.)



Wage inequalities

- Williamson (1965): U-shaped patterns of wages
- Explore the wage inequality between developing and developed countries
  - two-country model
  - two kinds of first natures, Ricardo+ H-O
  - second nature: IRS

$$\pi_n = p_{nn}d_{nn} + p_{ns}d_{ns} - \frac{\sigma-1}{\sigma}\eta w(d_{nn} + \tau d_{ns}) - r_n$$



$$\pi_s = p_{ss}d_{ss} + p_{sn}d_{sn} - \frac{\sigma-1}{\sigma}(d_{ss} + \tau d_{sn}) - \kappa r_s.$$

Key Parameters η, κ and γ

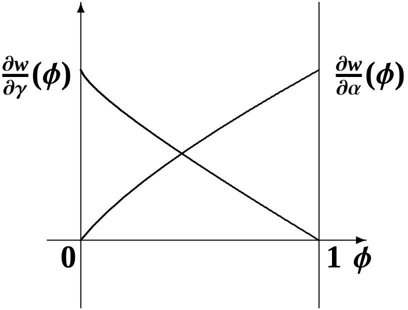
- **Ricardian Comparative Advantage** (technology)
  - $\pi_n = p_{nn}d_{nn} + p_{ns}d_{ns} - \frac{\sigma-1}{\sigma}\eta w(d_{nn} + \tau d_{ns}) - r_n$
  - $\pi_s = p_{ss}d_{ss} + p_{sn}d_{sn} - \frac{\sigma-1}{\sigma}(d_{ss} + \tau d_{sn}) - \kappa r_s$
  - $\alpha = \eta^{1-\sigma}\kappa \in (0, +\infty)$
- **Heckscher-Ohlin Comparative Advantage** (resource)
  - Large $\gamma \Rightarrow$ High per capita stock in developed country
  - $\gamma > \theta > 1/2 \Rightarrow$ Developed country is larger (America–Mexico)
  - $\theta < \gamma < 1/2 \Rightarrow$ Developed country is smaller (Japan–China)

Wage equation

- Firm share $k = \frac{\theta w}{\theta w + 1 - \theta}$
- $\mathcal{F}(w) \equiv \Psi_0(w) + \Psi_1(w)\phi + \Psi_2(w)\phi^2 = 0$
  - $\Psi_0(w) \equiv \alpha[w\theta(1-\gamma) - \gamma(1-\theta)]w^{1-\sigma}$
  - $\Psi_1(w) \equiv \sigma(1 - \theta - \alpha^2 w^{3-2\sigma}\theta)$
  - $\Psi_2(w) \equiv \alpha w^{1-\sigma}[(1-\theta)(\gamma-\sigma) + w\theta(\sigma+\gamma-1)]$
- Proposition 1 Wage w increases in α and γ
- Economics inside
  - Industry agglomerates according to the first nature.
  - The stronger the advantage is, the more the industry agglomerates.
  - Consistent with traditional theory.

On the first natures

- Proposition 2 When ϕ is small, $\frac{\partial w}{\partial \gamma}(\phi) > \frac{\partial w}{\partial \alpha}(\phi)$. When ϕ is large, $\frac{\partial w}{\partial \alpha}(\phi) > \frac{\partial w}{\partial \gamma}(\phi)$.



- Economics inside

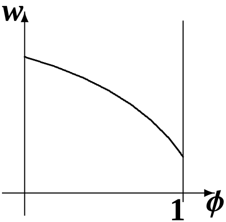
On the first natures (cont.)

- High trade costs (ϕ is small):
  The H-O advantage > The Ricardian advantage.
  - Hard to serve the foreign market ⇒ Higher efficiency in North does not rise capital return ⇒ Ricardian advantage is weak.
  - Since market access is important ⇒ Income Distribution is important ⇒ the H-O advantage is strong.
- Low trade costs (ϕ is large):
  The Ricardian advantage > The H-O advantage.
  - Easy to serve the foreign market ⇒ Higher efficiency in North does rise capital return ⇒ Ricardian advantage is strong.
  - Since labor access is important ⇒ Endowment of mobile factor is less important ⇒ the H-O advantage is weak.

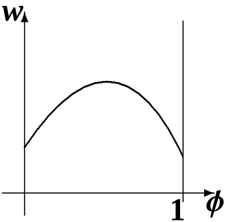
Wage curve

- Proposition 3 The possible forms of $w(\phi)$ are increasing, decreasing, U shape or inverted-U shape, as shown in the following figures.
- Existing theoretical studies are limited.
  - Simple evolution pattern
    - **Divergence**: Krugman (1991), Forslid and Ottaviano (2003).
    - **Inverted U-pattern**: Venables (1996), Puga (1999), Picard and Zeng (2010), Amiti (2005), Epifani (2005) and Tabuchi and Thisse (2002).
  - Most papers refer to regional inequality in terms of firm share rather than income

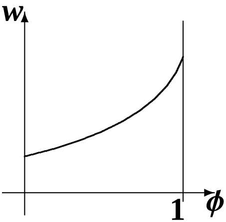
Wage curve (cont.)



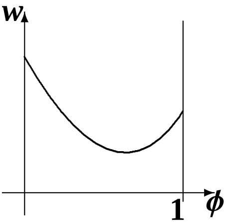
Form I: decreasing



Form II: inverted-U shape



Form III: increasing



Form IV: U shape

Endogenous offshoring

- Offshoring and onshoring
  - Offshoring: do some tasks abroad
  - Obama (2012, address to Congress): “We have a huge opportunity, at this moment, to bring manufacturing back.”
  - General Electric has decided to move production of a water heater to Louisville of Kentucky, from China
  - NCR, a maker of self-service kiosks and automated teller machines, has shifted jobs to Columbus of Georgia
- IRS needs to be addressed. NEG/NTT models are necessary. But
  - most NEG models have exogenous wages, no onshoring
  - existing NEG/NTT models are limited to corner equilibrium

Application to offshoring

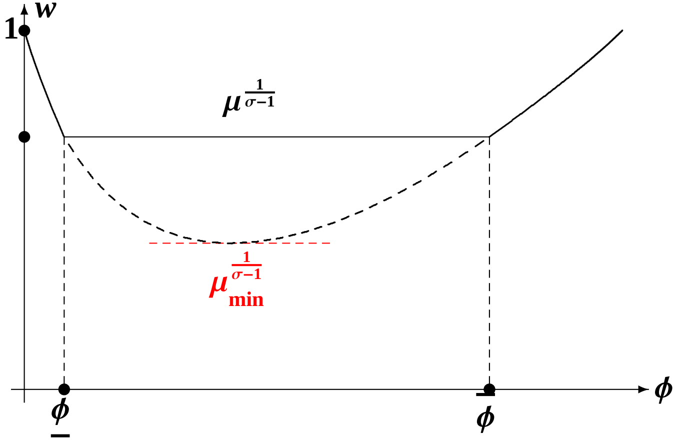
- Economy space: larger country 1 and smaller country 2
  - Wages: $w_1 = 1$, $w_2 = w$. Without offshoring, $1 \geq w$
  - Offshoring volume: share m tasks of firms in country 1 offshore to country 2
- Offshoring cost ξ: ICT (information and communication technologies)
  - foreign labor is discounted by $\xi \geq 1$
  - offshoring freeness $\mu = \xi^{1-\sigma}$
- profits of firms in country 1

$$\pi_1 = p_{11}d_{11} + p_{12}d_{12} - \frac{\sigma - 1}{\sigma}\widetilde{w}_1(d_{11} + \tau d_{12}) - r_1$$

$$\widetilde{w}_1 = (1 - m)w_1 + m\xi w_2$$

Wage curve

- Whenever offshoring happens, $w = 1/\xi$
- no offshoring if w is high enough



Wage curve (cont.)

$$\underline{\phi} = \frac{\sigma[\theta\mu^2 - (1-\theta)\mu^{\frac{1}{\sigma-1}}] - \sqrt{\Delta_2}}{2\mu\mathcal{A}_0},$$

$$\overline{\phi} = \frac{\sigma[\theta\mu^2 - (1-\theta)\mu^{\frac{1}{\sigma-1}}] + \sqrt{\Delta_2}}{2\mu\mathcal{A}_0},$$

where

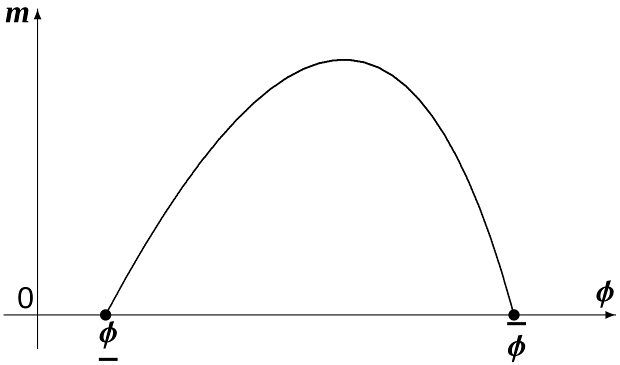
$$\Delta_2 = \sigma^2[\theta\mu^2 - (1-\theta)\mu^{\frac{1}{\sigma-1}}]^2 - 4\theta\mu^2(1-\theta)(1-\mu^{\frac{1}{\sigma-1}})\mathcal{A}_0,$$

$$\mathcal{A}_0 = (2\theta - 1)\sigma + (1-\mu^{\frac{1}{\sigma-1}})(1-\theta)(\sigma-\theta) > 0.$$

$$\mu_{\min} \Longrightarrow \Delta_2 = 0,\ \underline{\phi} = \overline{\phi}$$

Offshoring volume

- Proposition 1 For $\phi \in [\underline{\phi}, \bar{\phi}]$, offshoring volume evolves in an inverted-U pattern when transport costs decline.



Offshoring volume (cont.)

- Empirical support
- Figure 3
  - Offshoring keeps increasing for all nine industries until 2007.
  - From 2007, the fragmentation intensity in industries like furniture and fixtures, electrical equipment shows a tendency to slow down.
  - The offshoring volume even descends to form an inverted-U pattern in industries like primary metal manufacturing, miscellaneous manufactured commodities, plastics and rubber products.

Welfare of offshoring

$$\omega_1 = \frac{[1-\theta+(\sigma+\theta-1)\mu^{\frac{1}{1-\sigma}}]^{\frac{\sigma}{\sigma-1}}}{\sigma-1}\left[\frac{K\theta(1-\phi^2)\mu}{\sigma(1-\phi\mu)(1-\theta+\theta\mu^{\frac{1}{1-\sigma}})}\right]^{\frac{1}{\sigma-1}},$$

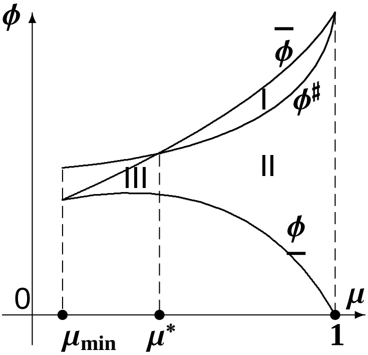
$$\omega_2 = \frac{(\sigma-\theta+\theta\mu^{\frac{1}{1-\sigma}})^{\frac{\sigma}{\sigma-1}}}{\sigma-1}\left[\frac{K(1-\theta)(1-\phi^2)\mu}{\sigma(\mu-\phi)(1-\theta+\theta\mu^{\frac{1}{1-\sigma}})}\right]^{\frac{1}{\sigma-1}}.$$

- Japan is worrying about the hollowing out of industry
- Two kinds of globalization
  - $\phi \uparrow$
  - $\mu \uparrow$

Welfare of offshoring (cont.)

Let

$$\phi^\sharp = \frac{1 - \sqrt{1 - \mu^2}}{\mu}$$



- Proposition 2
  - In area I, ω_1 decreases in ϕ.
  - In II & III, ω_1 increases in ϕ;
  - ω_2 always increases in ϕ.
- Economics inside
  - When $\phi\uparrow$, firms $\longrightarrow$ country 2
    - Price $\downarrow$, firm share $\downarrow$
  - When offshoring is easy, $\omega_1(\phi)$ has an inverted-U shape
  - When offshoring is difficult, $\omega_1(\phi)$ increases

Welfare of offshoring (cont.)

- Proposition 3
  - $\mu \uparrow \Rightarrow \omega_1 \uparrow$
  - $\mu \uparrow \Rightarrow \omega_2 \downarrow$
- Contrastive to Fujita and Thisse (2006), Robert-Nicoud (2008)
  - They consider corner equilibrium agglomeration in country 1
  - No firms move from country 2 to country 1, which is captured here

Conclusion

- With mobile capital, we do not need A in NTT
- The HME is a quite general property. Definition by wage is the best
- Without the wage equalization, we can analyze various wage inequalities
- Application to offshoring and others (?)