Trading Tasks: A Simple Theory of Offshoring

Gene M. Grossman and Esteban Rossi-Hansberg

Princeton University

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Introduction

- The nature of international trade has changed
- For centuries, trade largely entailed an exchange of complete goods
- Now, trade increasingly involves bits of value being added in many different locations: *Trade in tasks!*
  - Boom in “offshoring” of both manufacturing tasks and other business functions
- Need for a new paradigm, one that puts task trade at center stage
- The paper develops a simple and tractable model of offshoring that features such trade in tasks
Towards a New Paradigm

- A different conceptualization of the production process
  - Production of every good requires the performance of a continuum of tasks by each of the factors of production
  - Tasks might be performed in different locations
  - Firms are motivated to offshore tasks by factor-cost savings, but trading tasks is costly

- A model with two industries, perfect competition, and two factors of production

- The authors study how decreases in offshoring costs affect the wages of different types of labor

- They find that low-skilled workers may benefit from the production of low-skilled tasks abroad
The Model

- Model allows trade in tasks, as well as trade in goods
- Production involves a continuum of $L$ tasks and continuum of $H$ tasks
- Industries differ in factor intensity, as usual
- Normalize measure of tasks of each type to one
- Cost of offshoring task $i$ is given by $\beta t(i) \geq 1$
- Order tasks so $t'(i) \geq 0$ and assume $t(i)$ is continuously differentiable
- For the moment only $L$-tasks can be offshore and same $t(i)$ schedule in each industry
Firm’s Problem

- Consider production in sector $j \in \{X, Y\}$
- Assume firms, or industry, produces using a Constant Returns to Scale technology
- Firms maximize profits

$$\max_{Y_j, l_j} \{p_j Y_j - c_j Y_j\}$$

where

$$c_j = wa_{L_j}(1 - l_j) + w^* a_{L_j} \int_0^{l_j} \beta t(i) di + sa_{H_j} + \ldots$$

- Firm will offshore tasks $[0, l_j]$ where

$$w = \beta t(l_j)w^*,$$

and if the firm produces a positive amount

$$p_j = c_j$$
Cost of producing good $j$ using home technology are given by

$$c_j = w a_L (1 - l) + w^* a_L \int_0^l \beta t(i) di + s a_H$$

$$= w a_L (1 - l) + w a_L \frac{\int_0^l t(i) di}{t(l)} + s a_H$$

$$= w a_L \Omega(l) + s a_H$$

where

$$\Omega(l) = 1 - l + \frac{\int_0^l t(i) di}{t(l)} \text{ with } \Omega'(l) \leq 0$$

So possibility of offshoring affects costs exactly as labor-augmenting technological change.
Equilibrium

- Assume that both industries are active, then price is equal to unit cost (good X is numeraire and skill intensive)

\[
\begin{align*}
1 & = w_Ω a_{Lx} + s a_{Hx} \\
p & = w_Ω a_{Ly} + s a_{Hy}
\end{align*}
\]

- Factor market clearing implies

\[
\begin{align*}
a_{Lx} x (1 - l) + a_{Ly} y (1 - l) & = L \iff \\
a_{Lx} x + a_{Ly} y & = \frac{L}{1 - l} \\
a_{Hx} x + a_{Hy} y & = H.
\end{align*}
\]

- These 4 equations determine \( x, y, w_Ω, s \) as functions of \( p, l \) and \( L, H \).
Consider a small economy ($p$ and $w^*$ fixed) with two factors, $L$ and $H$, and two goods. Then

\[
1 = w\Omega a_{Lx}(w\Omega/s) + sa_{Hx}(w\Omega/s)
\]
\[
p = w\Omega a_{Ly}(w\Omega/s) + sa_{Hy}(w\Omega/s)
\]

which implies that $w\Omega$ and $s$ depend only on $p$. That is,

\[
\hat{w} = -\hat{\Omega} \text{ and } \hat{s} = 0
\]

Therefore, if $\beta$ goes down, then $I$ goes up and, thereby, $\Omega$ goes down, implying that

\[
\hat{w} \geq 0.
\]
Large Heckscher-Ohlin Economy

- Need a reason for differences in factor prices across countries
  - Assume foreign country has inferior technology so that offshoring flows in one direction
  - Let $A^*$ measure Hicks-neutral technological inferiority in both industries, then with incomplete specialization

\[
A^* a_{Lx} w^* + A^* a_{Hx} s^* = 1
\]
\[
A^* a_{Ly} w^* + A^* a_{Hy} s^* = p
\]

- Incomplete specialization implies that in equilibrium there is adjusted Factor Price Equalization:

\[
w\Omega = w^* A^*
\]
\[
s = s^* A^*
\]
This implies that both countries have similar $a_{Fj}$, so factor clearing conditions are given by

\[
A^* a_{Lx} x^* + A^* a_{Ly} y^* + \beta \int_0^I t(i) di \left( a_{Lx} x + a_{Ly} y \right) = L^*
\]

\[
A^* a_{Hx} x^* + A^* a_{Hy} y^* = H^*
\]

or

\[
a_{Lx} x^* + a_{Ly} y^* = \frac{L^* - \beta L}{A^*} \left(1 - I\right) \int_0^I t(i) di
\]

\[
a_{Hx} x^* + a_{Hy} y^* = \frac{H^*}{A^*}
\]
Large Heckscher-Ohlin Economy

- After some algebra

\[ x + x^* = \frac{a_{Ly} \left( H + \frac{H^*}{A^*} \right) - a_{Hy} \left( \frac{L}{\Omega} + \frac{L^*}{A^*} \right)}{\Delta a} \]

\[ y + y^* = \frac{a_{Hx} \left( \frac{L}{\Omega} + \frac{L^*}{A^*} \right) - a_{Lx} \left( H + \frac{H^*}{A^*} \right)}{\Delta a} \]

where \( \Delta a = a_{Hx} a_{Ly} - a_{Lx} a_{Hy} > 0. \)

- Goods market equilibrium:

\[ \frac{y + y^*}{x + x^*} = D(p) \]

where \( D(p) \) is the world relative demand: \( D'(p) < 0. \)

- If \( \beta \downarrow \implies I \uparrow \) and \( \Omega \downarrow. \) This in turn implies that \( \frac{y + y^*}{x + x^*} \uparrow \) and \( p \) falls: \( \hat{p} < 0. \)
Large Heckscher-Ohlin Economy

- Hence, $p \downarrow$ implies Relative Price Effect favors $H$ and harms $L$

- Overall:
  \[ \hat{w} = -\hat{\Omega} + \mu_1 \hat{p} \]

  and
  \[ \hat{s} = -\mu_2 \hat{p} \]

  - $H$ must gain, $L$ may gain or lose
  - Possible Pareto gains for home country if productivity effect large enough

- Note complete analogy with labor-augmenting technological progress in home country
Conclusion

- In the past:
  - Countries produced mostly complete products that they consumed and traded with other nations

- Today:
  - Drastic reductions in transport and communication costs have facilitated direct trade in tasks
  - Traditional benefits from worker specialization plus gains generated when tasks are performed at the lowest cost location

- Proposed a new paradigm where task trade takes center stage and:

  Offshoring of a particular factor’s tasks is equivalent to factor-augmenting technological progress

- Offshoring may lead to Pareto gains for source country