14.54 International Trade
— Lecture 25: Offshoring —
Do Old Rules Still Apply?
Today’s Plan

1. A Simple Theory of Offshoring
2. Consequences of Offshoring
3. Final Review
4. Course Evaluations
The International Division of Labor: Yesterday

- Adam Smith’s (1776) pin factory:
  "One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about 18 distinct operations”

- International Division of Labor in XIXth, XXth century:
  - Specialization implies geographic concentration
  - Factories produce goods, which are shipped to final consumers
  - If consumers are in a different country, there is international trade
International Division of Labor in XXIst century:

- Revolutionary progress in communication and information technologies have lead to breakup of the production process
- Countries still produce some goods from start to finish
- But they increasingly participate in global supply chains in which the many tasks required to manufacture complex industrial goods are performed in several, disparate locations

Offshoring \( \equiv \) Phenomenon by which tasks formerly undertaken in one country are now performed abroad

- This is associated with vertical FDI in last class’ terminology
- Offshoring is also referred to as “outsourcing” in popular discussions
The Making of an ”American” Car

Annual report of the World Trade Organization in 1998 describes the production of a particular “American” car:

1. 30% of the car’s value goes to Korea for assembly
2. 17.5% percent goes to Japan for components and advanced technology
3. 7.5% to Germany for design
4. 4% to Taiwan and Singapore for minor parts
5. 2.5% to the United Kingdom for advertising and marketing services
6. 1.5 % to Ireland and Barbados for data processing

Only 37% of the production value is generated in the United States!
The Making of a Barbie Doll by Mattel

- **OIL (SAUDI ARABIA)**
- **REFINES OIL INTO ETHYLENE FOR PLASTIC PELLETS (TAIWAN)**
- **LABOR, COTTON, CLOTHING (CHINA)**
- **CARDBOARD PACKAGING, PAINT PIGMENTS, MOLDS (US)**
- **TOY STORE (US)**
- **NYLON HAIR (JAPAN)**

Image by MIT OpenCourseWare.
Who Makes the Apple Ipod?

<table>
<thead>
<tr>
<th>Component</th>
<th>Supplier</th>
<th>Company HQ Location</th>
<th>Estimated Factory Price</th>
<th>Price as % of total factory cost</th>
<th>Gross Profit Rate</th>
<th>Est'd Value Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Drive</td>
<td>Toshiba</td>
<td>Japan</td>
<td>$73.39</td>
<td>50%</td>
<td>26.5%</td>
<td>$19.45</td>
</tr>
<tr>
<td>Display Module</td>
<td>Toshiba-Matsushita</td>
<td>Japan</td>
<td>$23.27</td>
<td>16%</td>
<td>28.7%</td>
<td>$6.68</td>
</tr>
<tr>
<td>Video/Multimedia Processor</td>
<td>Broadcom</td>
<td>US</td>
<td>$8.36</td>
<td>6%</td>
<td>52.5%</td>
<td>$4.39</td>
</tr>
<tr>
<td>Controller</td>
<td>PortalPlayer</td>
<td>US</td>
<td>$4.94</td>
<td>3%</td>
<td>44.8%</td>
<td>$2.21</td>
</tr>
<tr>
<td>Insertion, test, and assembly</td>
<td>Inventec</td>
<td>Taiwan</td>
<td>$3.86</td>
<td>2%</td>
<td>N.A.**</td>
<td>$3.86</td>
</tr>
<tr>
<td>Battery Pack</td>
<td>Unknown</td>
<td>Japan*</td>
<td>$2.89</td>
<td>2%</td>
<td>30%*</td>
<td>$0.87</td>
</tr>
<tr>
<td>Mobile SDRAM Memory - 32 MB</td>
<td>Samsung</td>
<td>Korea</td>
<td>$2.37</td>
<td>2%</td>
<td>28.2%</td>
<td>$0.67</td>
</tr>
<tr>
<td>Back Enclosure</td>
<td>Unknown</td>
<td>Taiwan*</td>
<td>$2.30</td>
<td>2%</td>
<td>30%*</td>
<td>$0.69</td>
</tr>
<tr>
<td>Mainboard PCB</td>
<td>Unknown</td>
<td>Taiwan*</td>
<td>$1.90</td>
<td>1%</td>
<td>30%*</td>
<td>$0.57</td>
</tr>
<tr>
<td>Mobile RAM - 8 MBytes</td>
<td>Elpida</td>
<td>Japan</td>
<td>$1.85</td>
<td>1%</td>
<td>24.0%</td>
<td>$0.46</td>
</tr>
<tr>
<td><strong>Subtotal for 10 most expensive inputs</strong></td>
<td></td>
<td></td>
<td><strong>$125.13</strong></td>
<td><strong>85%</strong></td>
<td></td>
<td><strong>$39.85</strong></td>
</tr>
<tr>
<td>All other inputs</td>
<td></td>
<td></td>
<td>$19.28</td>
<td>15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total all iPod inputs</td>
<td></td>
<td></td>
<td>$144.40</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Portelligent, Inc., 2006 and authors' calculations

* Supposition based on other iPod models or Apple products
** See text for explanation of how Inventec's gross margin is calculated

© ACM. All rights reserved. This content is excluded from our Creative Commons license. For more information, see [https://ocw.mit.edu/help/faq-fair-use/](https://ocw.mit.edu/help/faq-fair-use/).
Figure 1: Imported Inputs
Source: OECD Input-Output Matrices

- Share of Imported Inputs in Total Inputs in Goods Producing Sectors, US
- Share of Imported Inputs in Gross Output in Goods Producing Sectors, US

Courtesy of Gene M. Grossman and Esteban Rossi-Hansberg. Used with permission.
Econometric Evidence (II): Trade in Services

Figure 3: Total Imports of Business, Professional, and Technical Services

Source: BEA

Courtesies of Gene M. Grossman and Esteban Rossi-Hansberg. Used with permission.
Figure 2: Related Party Trade as a Share of U.S. Imports

Source: BEA

<table>
<thead>
<tr>
<th>Year</th>
<th>CHINA</th>
<th>KOREA</th>
<th>MEXICO</th>
<th>TAIWAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Courtesy of Gene M. Grossman and Esteban Rossi-Hansberg. Used with permission.
Econometric Evidence (IV): Labor Market

Figure 4: Trends in Nonroutine and Routine Tasks
Source: Autor, Levy and Murnane (2003)

![Graph showing trends in nonroutine and routine tasks.](image)

Courtesy of Gene M. Grossman and Esteban Rossi-Hansberg. Used with permission.
Questions

- What are the consequences of "Globalization" when trade involves trade in *tasks* rather than trade in *final goods*?
- Who are the winners and losers of offshoring?
1. A Simple Theory of Offshoring
Main Assumptions

- We consider a model developed by Grossman and Rossi-Hansberg
- As in Heckscher-Ohlin model:
  - There are two countries, Home and Foreign
  - There are 2 tradeable goods, C and F
  - There are two factors of production, L and H
- In contrast with Heckscher-Ohlin model:
  - Production process involves a large number of tasks \( i \in [0, 1] \)
- Tasks are of two types:
  - \( L \)-tasks which require 1 units of low-skilled labor
  - \( H \)-tasks which require 1 units high-skilled labor
Tasks vary in their offshoring costs

- because some tasks are easier to codify
- because some services must be delivered personally, while others can be performed at a distance with little loss in quality

To capture this idea, we assume that:

- $H$-tasks cannot be offshored
- $L$-tasks can be offshored, but amount of low-skilled labor necessary to perform task $i$ abroad is given by $\beta t(i) > 1$

Under this assumption,

- $\beta$ reflects overall feasibility of offshoring at a point in time (e.g. communication technology)
- $t(i)$ is an increasing function which captures differences in offshoring costs across tasks (e.g. cleaning room vs. call center)
The Offshoring Decision

- Suppose that wages for low-skilled labor are higher at Home
  \[ w > w^* \]

- Benefit of offshoring ≡ lower wages abroad
- Cost of offshoring ≡ loss in productivity captured by \( \beta t(i) \)
- In a competitive equilibrium, firm will offshor tasks if and only if:
  \[ \beta t(i) w^* < w \]

- Let \( I \in [0, 1] \) denote the marginal task that is being offshored
  \[ \beta t(I) w^* = w \]  \hspace{1cm} (1)
2. Consequences of Offshoring
The cost of producing one unit of some good is given by

\[ c = a_L [w(1 - I) + w^* \beta T(I)] + a_H s \]  

(2)

with \( T(I) \equiv \int_0^I t(i) di \), \( s \equiv \) wage of high-skilled workers at Home

Substituting (1) into (2), we obtain

\[ c = a_L w\Omega + a_H s \]

where \( \Omega = (1 - I) + \frac{T(I)}{t(I)} < 1 \)

This looks just like the cost equation of a firm that employs low-skilled workers whose productivity is (inversely) measured by \( \Omega \)

Hence, offshoring is economically equivalent to labor-augmenting technological progress
Consequences of a Reduction in Offshoring Costs

- Consider a decrease in $\beta$ (introduction of fax machine, email, mobile telephony, videoconferencing, etc.)
- What happens to the domestic wage of low-skilled workers?

\[
\hat{w} = -\hat{\Omega} - \alpha_1 \hat{p} - \alpha_2 \frac{dl}{1 - I}
\]

- First term $\equiv$ Productivity Effect
  - Fall in $\Omega$ boosts demand for low-skilled labor and, thus, push up their wages, like factor augmenting technological change

- Second term $\equiv$ Relative-price Effect
  - Like Stolper-Samuelson channel in Heckscher-Ohlin model
  - $\alpha_1$ depends on differences in factor intensities in the two sectors

- Third term $\equiv$ Labor-supply Effect
  - $dl > 0$ frees up the domestic labor that otherwise would perform these tasks, and so has effects analogous to increase in supply of this factor
What happens to the domestic wage of high-skilled workers?

\[ \hat{s} = \alpha_3 \hat{p} + \alpha_4 \frac{dl}{1 - l} \]

- There is no direct productivity effect (no offshoring)
- The first term also reflects a Stolper-Samuelson like effect
  - This is beneficial for high-skilled workers if the relative price of the skill intensive good goes up
- The second term also reflects the freeing up of domestic low-skilled labor associated with offshoring
  - This is beneficial for high-skilled workers because they become relatively more scarce
Proposition If Home is a small open economy that produces both goods, a decrease in $\beta$ increases $w$ and leaves $s$ unchanged

Proof:
1. Zero profit requires:

$$p_i = a_{Li}w\Omega + a_{Hi}s, \ i = 1, 2$$

2. Since Home a small open economy, $p_i$ does not depend on $\beta$

3. This implies that $w\Omega$ and $s$ do not depend on $\beta$ either

4. Since $\Omega$ is decreasing in $\beta$, we get $w$ increasing in $\beta$
By assumption, there are no changes in world prices: \( \hat{p} = 0 \)

With two goods and two factors, changes in factor supplies do not affect factor prices, as long as both industries are active: \( \alpha_2 = \alpha_4 = 0 \)

- An increase in the supply of low-skilled labor leads to an expansion of the labor-intensive sector and a contraction of the skill-intensive sector (Rybczynski effect)

- As a result, a reduction in offshoring costs implies

\[
\begin{align*}
\hat{w} & = -\hat{\Omega} > 0 \\
\hat{s} & = 0
\end{align*}
\]

Low-skilled workers whose ”jobs” are being offshored are better off!
3. Final Review
Topics Covered

- All Lecture notes 1-25:
  - Basic facts about globalization
  - Endowment trade model
  - Standard trade model
  - Ricardian trade model
  - Specific factor model
  - Heckscher-Ohlin model
  - Increasing returns to scale
  - Trade policy
  - Factor mobility
  - Offshoring

- Textbook:
  - Chapters 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12

- Additional materials from the reading list are covered only if mentioned in class