Lecture 3b:
Specific-factor Model

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C181 – International Trade
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• CHAPTER 3: Road map:

• Setting up the specific factor model

• Change in production

• Aggregate gains from trade

• Effect on labor wages

• Effect on returns to K and Land
• CHAPTER 3: Road map:

• Setting up the specific factor model

• Change in production

• Aggregate gains from trade

→ Effect on labor wages?

→ Effect on returns to Capital and Land?
3 Gains from Trade

Gains for everyone?

• When there are gains from trade *on average*, it does not imply that everyone gains from trade

• The interesting part of the model is to examine what happens to the return to each factor:
  1) Labor wage
  2) Rental rate of Capital and Land

Do workers gain? Do land and capital owner gain?
3 Gains from Trade

Gains for everyone?

1) What about laborers?
   Does income from labor increase?
3 Gains from Trade

Gains for everyone?

1) What about laborers?
   Does income from labor increase?

➤ Ambiguous! Workers do not necessarily gain
3 Gains from Trade

Gains for everyone?

1) What about laborers?

Equilibrium wages:
• In equilibrium, wages are equalized across industries.
• This implies:

\[ w = P_M \cdot MPL_M = P_A \cdot MPL_A \]
3 Gains from Trade

*Diminishing returns* for labor in each industry:

(same for Agriculture)
3 Gains from Trade

Combining the two industries on the same graph:

- Labor market equilibrium
- Value of marginal product of labor in agriculture
- Value of marginal product of labor in manufacturing
3 Gains from Trade

Gains for everyone?

Assume for now that $P_A$ doesn’t change and $P_M$ increases.

(Note: we would obtain similar results if $P_A$ decreases and $P_M$ doesn’t change; it’s all about relative prices.)
Effect of an increase in the price $P_M$

Vertical distance

$\Delta W = \Delta P_M \cdot MPL_M$

$P_A \cdot MPL_A$

$P_M \cdot MPL_M$

$W'$

$W$

$L_M$ →

$L_A$ ←
3 Gains from Trade

Do workers gain?
Can they buy more Agric. goods? More Manuf. Goods?

• Wage increases $\rightarrow$ workers can buy more Agri goods

• But do wages increase more than $P_M$?
Effect of an increase in the price $P_M$

Vertical distance

$\Delta W = \Delta P_M \cdot MPL_M$

$W'$

$W$

$P_A \cdot MPL_A$

$P_M' \cdot MPL_M$

$P_M \cdot MPL_M$

$L_M \rightarrow$

$L_A \leftarrow$

$L$
3 Gains from Trade

Do workers gain?

Can they buy more Agric. goods? More Manuf. Goods?

• Wage increases $\rightarrow$ workers can buy more A’ goods

• But workers can’t buy as much Manuf goods as before:

$$\Delta W < \Delta P_M \cdot MPL_M$$

(see graph) which implies:

$$\frac{\Delta W}{W} < \frac{\Delta P_M \cdot MPL_M}{W} = \frac{\Delta P_M}{P_M}$$
3 Gains from Trade

More details:

- Change in wages:

\[ \Delta W = \Delta (P_M \cdot MPL_M) \]

\[ = \Delta P_M \cdot MPL_M + P_M \cdot \Delta MPL_M \]

- Since workers are moving from Ag to Manuf, MPL\textsubscript{M} decreases and thus:

\[ \Delta W < \Delta P_M \cdot MPL_M \]

- For relative wages:

\[ \frac{\Delta W}{W} < \frac{\Delta P_M \cdot MPL_M}{W} = \frac{\Delta P_M \cdot MPL_M}{P_M \cdot MPL_M} = \frac{\Delta P_M}{P_M} \]
Clicker question:

Suppose that the price of manufacturing does not change but that the price of agricultural goods decreases by 1%. We get:

a) Wages decrease but not as fast as the price of Agricultural goods, i.e. decline by less than 1%

b) Wages decrease faster than the price of Agricultural goods, i.e. decline by more than 1%

c) Wages increase by more than 1%

d) Wages increase but increase by less than 1%
3 Gains from Trade

Clicker question:

Suppose that the price of manufacturing does not change but that the price of agricultural goods decreases by 1%. We get:
Clicker question:
Suppose that the price of manufacturing does not change but that the price of agricultural goods decreases by 1%. We get:

a) Wages decrease but not as fast as the price of Agricultural goods, i.e. decline by less than 1%

➔ In general, the relative change in wages will be in between the two price changes.
3 Gains from Trade

Gains for everyone?

1) What about laborers?

- Their income grow faster than the price of Agricultural products, but slower than the price of manuf. goods
- Overall effect is ambiguous and depends on preferences:
  - Workers may loose if they care a lot about manufacturing goods
3 Gains from Trade

Gains for Land and Capital owners?

2) What about income from Capital and Land? (Capital is used in Manuf, Land in Agriculture)
3 Gains from Trade

Gains for Land and Capital owners?

2) What about income from Capital and Land? (Capital is used in Manuf, Land in Agriculture)

- Rental rate of capital (machines)?
- Rental rate of land?
3 Gains from Trade

Gains for Land and Capital owners?

2) What about income from Capital and Land?
   (Capital is used in Manuf, Land in Agriculture)

• Rental rate of capital (machines):

\[ R_K = P_M \cdot MPK_M \]

• Rental rate of land:

\[ R_T = P_A \cdot MPT_A \]
3 Gains from Trade

Gains for Land and Capital owners?

Checking whether their budget line shifts:

• Can K owners buy more agricultural goods?
  Does $R_K / P_A$ increase?

• Can K owners buy more manufacturing goods?
  Does $R_K / P_M$ increase?

• Can Land owners buy more agricultural goods?
  Does $R_T / P_A$ increase?

• Can Land owners buy more manufacturing goods?
  Does $R_T / P_M$ increase?
Clicker question:

If the price of manufacturing goods increases, whose wage increases faster than the price of manufacturing goods?

a) Both Land owners and K owners’ income increases faster than the price of manufacturing goods

b) Only Land owners’ income increases faster than the price of manufacturing goods

c) Only K owners’ income increases faster than the price of manufacturing goods

d) Neither Land or K owners’ income increases faster than the price of manufacturing goods
3 Gains from Trade

Answer:

If the price of manufacturing goods increases, whose wage increases faster than the price of manufacturing goods?

c) Only K owners’ income increases faster than the price of manufacturing goods
3 Gains from Trade

Clicker question:

If the price of manufacturing goods increases, who can buy more agricultural goods?

a) It depends on preferences

b) K owners but not Land owners

c) Land owners but not K owners

d) Both

e) Neither
3 Gains from Trade

Answer:
If the price of manufacturing goods increases, who can buy more agricultural goods?

b) K owners for sure
Not Land owners for sure

*K owners are the big winners*
*Land owners are the big losers*
3 Gains from Trade

Gains for Land and Capital owners?

Recall that: \( R_K = P_M \cdot MPK_M \)

If workers move towards the manufacturing sector, the marginal product of capital increases
(because there are more workers to operate each machine)

- Since \( MPK_M \) increases, \( R_K / P_M = MPK_M \) also increases: Capital owners can buy more manuf. goods

- Since \( P_M / P_A \) increases, we can also conclude that: \( R_K / P_A = MPK_M \cdot P_M / P_A \) increases and that Capital owners can also buy more agricultural goods
3 Gains from Trade

Gains for Land and Capital owners?

Recall that: \( R_T = P_A \cdot MPT_A \)

If workers move away from the agricultural sector, the marginal product of land decreases
(because there are fewer workers to operate each machine)

- Since \( MPT_A \) decreases, \( R_T / P_A = MPT_A \) also decreases: Land owners can buy less agricultural goods

- Since \( P_A / P_M \) decreases, we can also conclude that: \( R_T / P_M = MPT_A \cdot P_A / P_M \) decreases and that Land owners can also buy less manufacturing goods
3 Gains from Trade

Adjustments: Summary (1/2)

• There are **two main adjustments** to opening to trade

When the price of manufacturing goods goes up:

1) Direct effect on real income:
   • Positively affects income in Manufacturing
   • Negatively affects the cost of living in Agriculture

2) Effect on productivity:
   Leads workers to move from Agriculture to Manufacturing:
   \[ \rightarrow \text{Affects MPL}_A, \text{MPL}_M, \text{MPK} \text{ and MPT} \]
3 Gains from Trade

Adjustments: Summary (2/2)

When workers move from Agriculture to Manufacturing, this leads to a…

- Decrease in MPL in Manufacturing
  → Mitigates the income increase for manuf workers

- Increase in MPL in Agriculture:
  → Mitigates the cost-of-living increase for Ag workers

- Increases in MPK
  → Magnifies the gains for K owners

- Decreases in MPT
  → Magnifies the loss for Land owners
3 Gains from Trade

Gains from trade?

- Gains on average for the economy

- Ambiguous for workers that are mobile between sectors

- Gains for factors trapped in the sector with a comparative advantage

- Loss for factors trapped in the sector with a comparative disadvantage
3 Gains from Trade

Quantitative implications:
Can we compare the gains/loss to the change in prices?
3 Gains from Trade

Clicker question:
In the specific-factor model, an increase in the price of manufacture \( \Delta P_M > 0 \) (keeping \( P_A \) constant) yields:

\[
\begin{align*}
a) \quad & \frac{\Delta R_T}{R_T} < 0 < \frac{\Delta W}{W} < \frac{\Delta P_M}{P_M} < \frac{\Delta R_K}{R_K} \\
b) \quad & \frac{\Delta R_T}{R_T} = 0 < \frac{\Delta P_M}{P_M} < \frac{\Delta W}{W} < \frac{\Delta R_K}{R_K} \\
c) \quad & \frac{\Delta R_T}{R_T} < 0 < \frac{\Delta P_M}{P_M} < \frac{\Delta R_K}{R_K} < \frac{\Delta W}{W}
\end{align*}
\]
3 Gains from Trade

Answer:

If the price of manufacturing goods increases by 10%:

• Wages increase by less than 10%

• The rental rate of Land decreases

• The rental rate of Capital increases by more than 10%

Hence:

\[
\frac{\Delta R_T}{R_T} < 0 < \frac{\Delta W}{W} < \frac{\Delta P_M}{P_M} = 10\% < \frac{\Delta R_K}{R_K}
\]
Clicker question:
In the specific-factor model, suppose that $P_M$ increases by 15% while $P_A$ increases by 10%, we get:

$$a) \quad \frac{\Delta R_K}{R_K} < 10\% < \frac{\Delta W}{W} < 15\% < \frac{\Delta R_T}{R_T}$$

$$b) \quad \frac{\Delta R_T}{R_T} < 10\% < \frac{\Delta W}{W} < 15\% < \frac{\Delta R_K}{R_K}$$

$$c) \quad \frac{\Delta R_K}{R_K} < 10\% < 15\% < \frac{\Delta W}{W} < \frac{\Delta R_T}{R_T}$$
3 Gains from Trade

Answer

In the specific-factor model, suppose that $P_M$ increases by 15% while $P_A$ increases by 10%, we get:

\[
b) \quad \frac{\Delta R_T}{R_T} < 10\% < \frac{\Delta W}{W} < 15\% < \frac{\Delta R_K}{R_K}
\]
Clicker question:
In the specific-factor model, suppose that $P_M$ decreases by 10% while $P_A$ increases by 5%, we get:

\[ a) \quad \frac{\Delta R_T}{R_T} < -10\% < \frac{\Delta W}{W} < 5\% < \frac{\Delta R_K}{R_K} \]

\[ b) \quad \frac{\Delta R_K}{R_K} < -10\% < \frac{\Delta W}{W} < 5\% < \frac{\Delta R_T}{R_T} \]

\[ c) \quad \frac{\Delta R_T}{R_T} < \frac{\Delta W}{W} < -10\% < 5\% < \frac{\Delta R_K}{R_K} \]

\[ d) \quad \frac{\Delta R_K}{R_K} < \frac{\Delta W}{W} < -10\% < 5\% < \frac{\Delta R_T}{R_T} \]
3 Gains from Trade

Answer

In the specific-factor model, suppose that $P_M$ decreases by 10% while $P_A$ increases by 5%, we get:

\[
b) \quad \frac{\Delta R_K}{R_K} < -10\% < \frac{\Delta W}{W} < 5\% < \frac{\Delta R_T}{R_T}
\]
3 Gains from Trade

Attention: Flipping price changes

If the price of Agriculture increases more than the price of Manufacturing goods:

**Results are flipped!**

- It implies that Home has a comparative advantage in Agriculture
- Gains for Land owners
- Loss for Capital owners
- Ambiguous effects for (mobile) workers
4 Applications

Further comments and illustrations:

• Examples of employment and factor price changes

• Effect of trade on labor when workers are not mobile

• How to compensate losers?
4 Applications

Further comments and illustrations:

→ Examples of employment and factor price changes

• Effect of trade on labor when workers are not mobile

• How to compensate losers?
4 Applications

Illustrations:

- Sector in the US with decreasing employment and lower earnings?
4 Applications

Illustrations:

• Agriculture:
  • Decreasing employment
  • Increasing size of farms
  • Lower returns to land?

    Land prices increase for other reasons…
Farms, land in farms, and average acres per farm, 1850–2012

Million farms/billion acres/hundred acres

4 Applications

Illustrations:

Better examples:

• Manufacturing as a whole:
  • Decreasing employment!
  • Lower wages

• Services:
  • Increasing employment
  • Increasing wages, especially since the early 90’s
4 Applications

Manufacturing employment (millions of workers)

Employment (left axis)

Share of total employment (right axis)

Manufacturing employment as a share of total employment (%)
4 Applications

Real hourly wages (2008 dollars)

- Information services
- Manufacturing
- All private services

Year


$32 $30 $28 $26 $24 $22 $20 $18 $16 $14 $12
4 Applications

Another illustrations: “China Syndrome”

Workers and politics often specifically worried about competition with Chinese imports. Is the fear justified?

• See Autor et al (2013 article on “China Syndrome”)

• Examine the effect of regional trade exposure to Chinese imports on employment across commuting zones (CZ’s):

  • *Results partially consistent with specific-factor model*
4 Applications

Employment effect of exposure to Chinese imports:

Change in manufacturing emp by CZ, 1990–2007

coef = -0.34, robust SE = 0.07, t = -4.77

Figure 2. Change in Import Exposure per Worker and Decline of Manufacturing Employment
### 4 Applications

Employment and wage effects of exposure to Chinese imports:

#### Table 7—Comparing Employment and Wage Changes in Manufacturing and outside Manufacturing, 1990–2007: 2SLS Estimates

**Dependent variables:** Ten-year equivalent changes in log workers and average log weekly wages

<table>
<thead>
<tr>
<th></th>
<th>I. Manufacturing sector</th>
<th>II. Nonmanufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All workers (1)</td>
<td>College (2)</td>
</tr>
<tr>
<td></td>
<td>All workers (4)</td>
<td>College (5)</td>
</tr>
</tbody>
</table>

**Panel A. Log change in number of workers**

(Δ imports from China to US)/worker

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.31</td>
<td>0.30</td>
<td>0.34</td>
<td>0.35</td>
<td>0.29</td>
<td>0.53</td>
</tr>
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<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>(1.047)</td>
<td>(1.181)</td>
<td>(1.243)</td>
<td>(0.651)</td>
<td>(0.590)</td>
<td>(0.764)</td>
</tr>
<tr>
<td>Δ imports from China</td>
<td>-4.231***</td>
<td>-3.992***</td>
<td>-4.493***</td>
<td>-0.274</td>
<td>0.291</td>
<td>-1.037</td>
</tr>
</tbody>
</table>

**Panel B. Change in average log wage**

(Δ imports from China to US)/worker

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.22</td>
<td>0.21</td>
<td>0.33</td>
<td>0.60</td>
<td>0.54</td>
<td>0.51</td>
</tr>
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<tr>
<td></td>
<td>(0.482)</td>
<td>(0.340)</td>
<td>(0.369)</td>
<td>(0.260)</td>
<td>(0.297)</td>
<td>(0.246)</td>
</tr>
<tr>
<td>Δ imports from China</td>
<td>0.150</td>
<td>0.458</td>
<td>-0.101</td>
<td>-0.761***</td>
<td>-0.743**</td>
<td>-0.822***</td>
</tr>
</tbody>
</table>

*Notes: N = 1,444 (722 CZs × two time periods). All regressions include the full vector of control variables from column 6 of Table 3. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period CZ share of national population.*

***Significant at the 1 percent level.*
4 Applications

Employment and wage effects of exposure to Chinese imports:

“Exposure”: Looking at industries depending on their exposure to Chinese import competition, i.e. share of workers working in industries with larger imports from China.

Higher “exposure” to Chinese imports lead to:

• Lower employment in manufacturing
• No change in services employment
• No changes in manufacturing wages
• Lower wages in services sectors

Interpretation: many workers lose their job. Those who find a job in services have lower wages as a result.
Further comments and illustrations:

- Examples of employment and factor price changes
- Effect of trade on labor when workers are not mobile

→ How to compensate losers?
4 Applications

Clicker question:

Getting back to the model, with industries A and M, with workers, land and capital.

- Workers sometimes lose
- Land owners always lose
- Capital owners gain

How to shield land owners and maybe workers from negative effects of trade?
4 Applications

Clicker question:

How to shield land owners (and maybe workers) from negative effects of trade? Redistributing to Land owners after raising a tax on…

a) Tax on Manufacturing production so that we decrease domestic Manufacturing production

b) Tax on imports of Agricultural goods so that we increase domestic Agricultural production

c) Subsidies for Agricultural production so that we increase domestic Agricultural production

d) Tax on revenues from capital
4 Applications

Answer:
4 Applications

Answer:

How to shield land owners (and maybe workers) from negative effects of trade?

→ The best is to redistribute wealth without affecting overall gains from trade, i.e. without affecting production in manufacturing vs. agricultural sector.
How to shield land owners (and maybe workers) from negative effects of trade?

→ The best is to redistribute wealth without affecting overall gains from trade, i.e. without affecting production in manufacturing vs. agricultural sector.

→ In this case, answer is **d): tax revenues from capital**
4 Applications

Clicker question:

Why not a), b) or c)?

a) Tax on Manufacturing production
b) Tax on imports of Agricultural goods
c) Subsidies (negative tax) for Agricultural production

Either approach will shift production B back towards Autarky equilibrium and would erode the gains from trade...

You want to cut the “cake” differently, not shrink the “cake”!
Moving production back to A would erode gains from trade.
Clicker question:

So why d)?

d) Tax on revenues from capital

Here, taxing capital would not affect production (fixed K):
→ Hence would not affect the aggregate gains from trade.

Caveats:

• Taxing capital would affect capital accumulation and decrease manufacturing production
• In the US, manufacturing relatively more affected than Agriculture and services
4 Applications

Clicker question:

In doubt? Policy recommendations:

• Foster **mobility** away from shrinking sectors

• **Redistribute** to those who are “trapped” in comparative disadvantage sectors
4 Applications

Example of redistribution program

Trade Adjustment Assistance (TAA) Program:

• Any case: unemployment insurance

• TAA program in manufacturing (since 1962):
  Additional unemployment/health insurance to workers who are laid off because of import competition.

• Jobs stimulus bill: signed on February 17, 2009:
  workers in the service sector (as well as farmers) who lose their jobs due to trade can now also apply for TAA.
4 Applications

Clicker question:

Workers displaced by competition from Chinese imports: Have they been (partially compensated)?

Yes (but not large enough to fully compensate their loss)

<table>
<thead>
<tr>
<th>Total individual transfers</th>
<th>TAA benefits</th>
<th>Unemployment benefits</th>
<th>SSA retirement benefits</th>
<th>SSA disability benefits</th>
<th>Medical benefits</th>
<th>Federal income assist</th>
<th>Educ/training assist</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
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<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
<tr>
<td>1.01***</td>
<td>14.41*</td>
<td>3.46*</td>
<td>0.72*</td>
<td>1.96***</td>
<td>0.54</td>
<td>3.04***</td>
<td>2.78**</td>
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<tr>
<td>(0.33)</td>
<td>(7.59)</td>
<td>(1.87)</td>
<td>(0.38)</td>
<td>(0.69)</td>
<td>(0.49)</td>
<td>(0.96)</td>
<td>(1.32)</td>
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<tr>
<td>$R^2$</td>
<td>0.57</td>
<td>0.28</td>
<td>0.48</td>
<td>0.36</td>
<td>0.32</td>
<td>0.27</td>
<td>0.54</td>
</tr>
</tbody>
</table>
Conclusion

Trade in specific-factor model:

Can be driven by either:
• Differences in technology
• Or differences in endowments (land or capital)

→ See chapter 4 on how differences in endowments generate trade
Conclusion

CHAPTER 3  –  Conclusions

• Gains on average for the economy
  • But: winners and losers
  • Factors trapped in comparative-disadvantage industries tend to loose
  • Possible to redistribute so that everyone gains

• Illustrations:
  • Manufacturing vs. Agriculture vs. Services
  • “China syndrome” (Autor Dorn and Hanson 2013)
  • Displaced workers: NAFTA compensation program