

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?

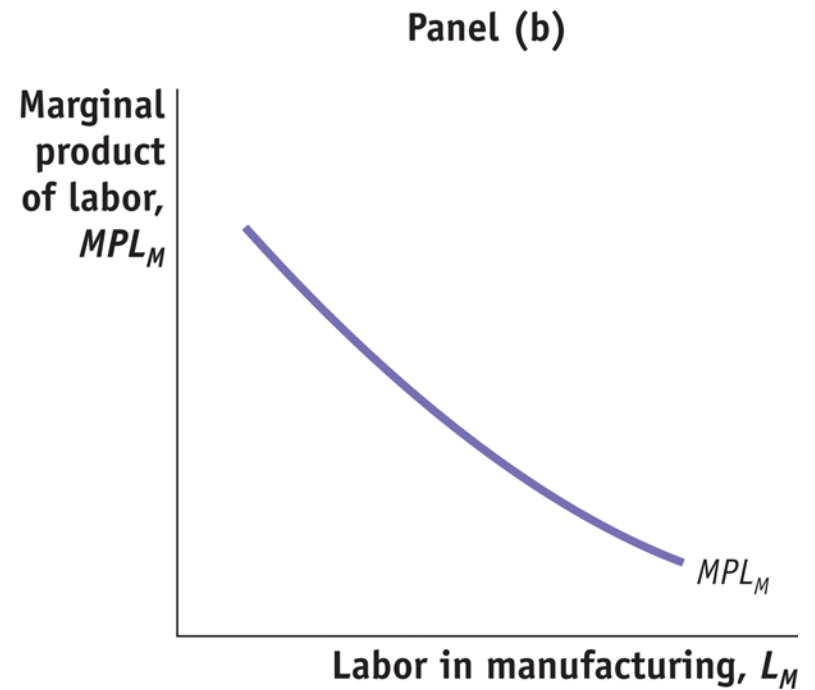
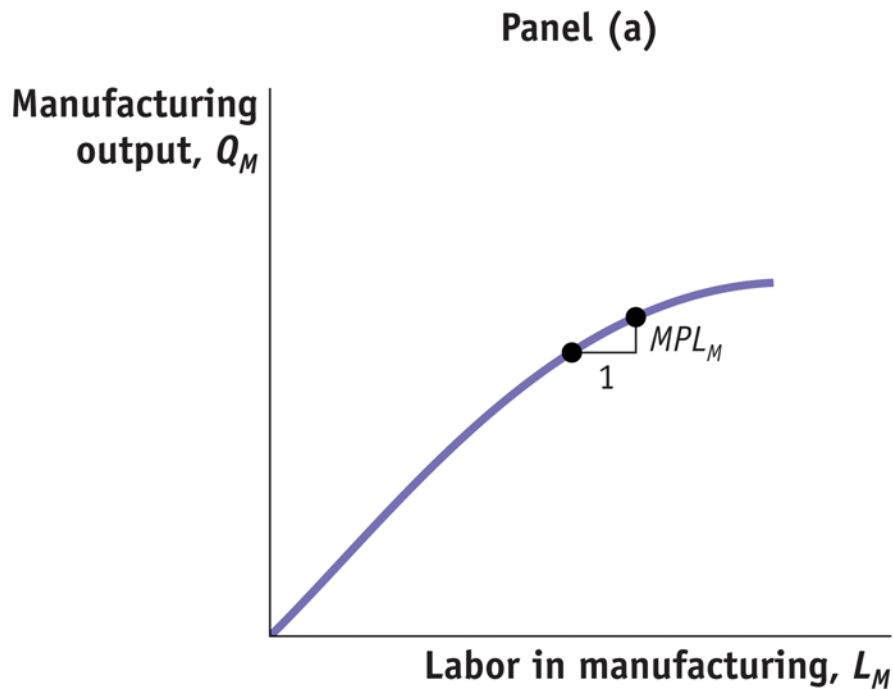
Equilibrium wages:

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

$$w = P_M \cdot MPL_M = P_A \cdot MPL_A$$

3 Gains from Trade

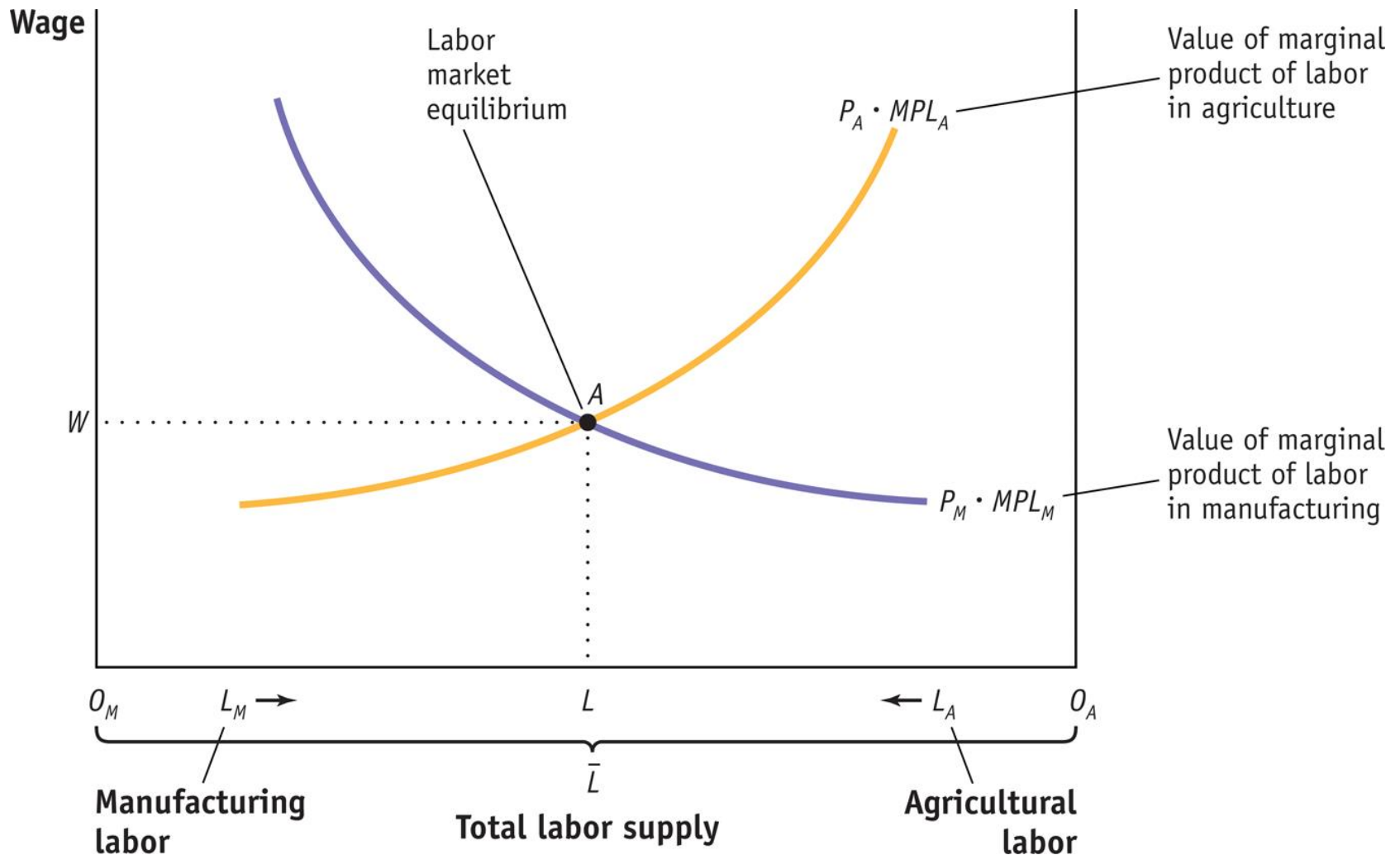
Diminishing returns for labor in each industry:



(same for Agriculture)

3 Gains from Trade

Combining the two industries on the same graph:



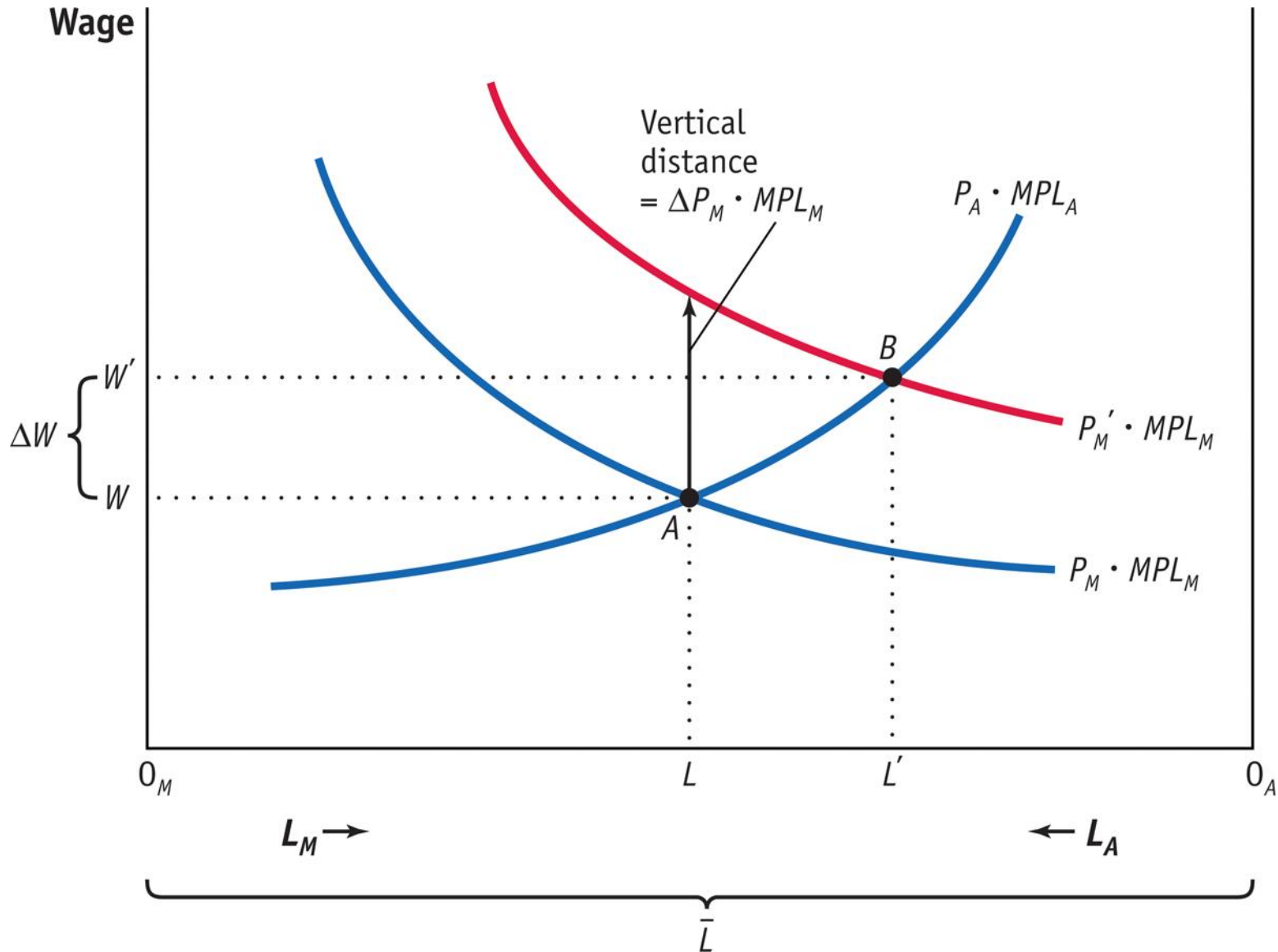
3 Gains from Trade

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



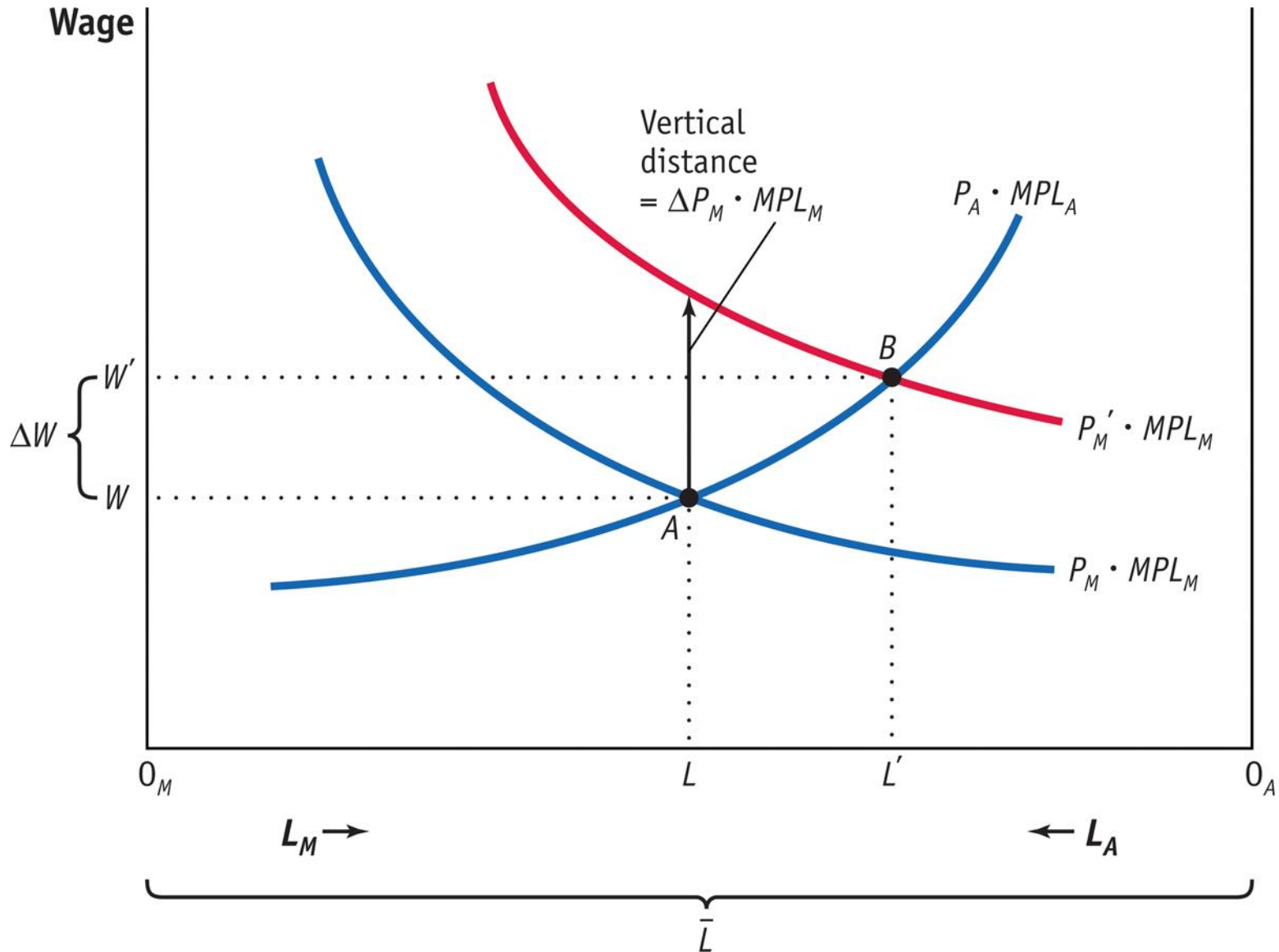
3 Gains from Trade

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



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:

$$\begin{aligned}\Delta W &= \Delta(P_M \cdot MPL_M) \\ &= \Delta P_M \cdot MPL_M + P_M \cdot \Delta MPL_M\end{aligned}$$

- Since workers are moving from Ag to Manuf, MPL_M decreases and thus:

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

- For relative wages:

$$\frac{\Delta W}{W} < \frac{\Delta P_M \cdot MPL_M}{W} = \frac{\Delta P_M \cdot MPL_M}{P_M \cdot MPL_M} = \frac{\Delta P_M}{P_M}$$

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:

- 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:

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:

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):

$$R_K = P_M \cdot MPK_M$$

- 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?

3 Gains from Trade

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 agricul. 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:

→ **Affects MPL_A , MPL_M , MPK 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:

$$a) \quad \frac{\Delta R_T}{R_T} < 0 < \frac{\Delta W}{W} < \frac{\Delta P_M}{P_M} < \frac{\Delta R_K}{R_K}$$

$$b) \quad \frac{\Delta R_T}{R_T} = 0 < \frac{\Delta P_M}{P_M} < \frac{\Delta W}{W} < \frac{\Delta R_K}{R_K}$$

$$c) \quad \frac{\Delta R_T}{R_T} < 0 < \frac{\Delta P_M}{P_M} < \frac{\Delta R_K}{R_K} < \frac{\Delta W}{W}$$

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:

$$a) \quad \frac{\Delta R_T}{R_T} < 0 < \frac{\Delta W}{W} < \frac{\Delta P_M}{P_M} = 10\% < \frac{\Delta R_K}{R_K}$$

3 Gains from Trade

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:

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

3 Gains from Trade

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?

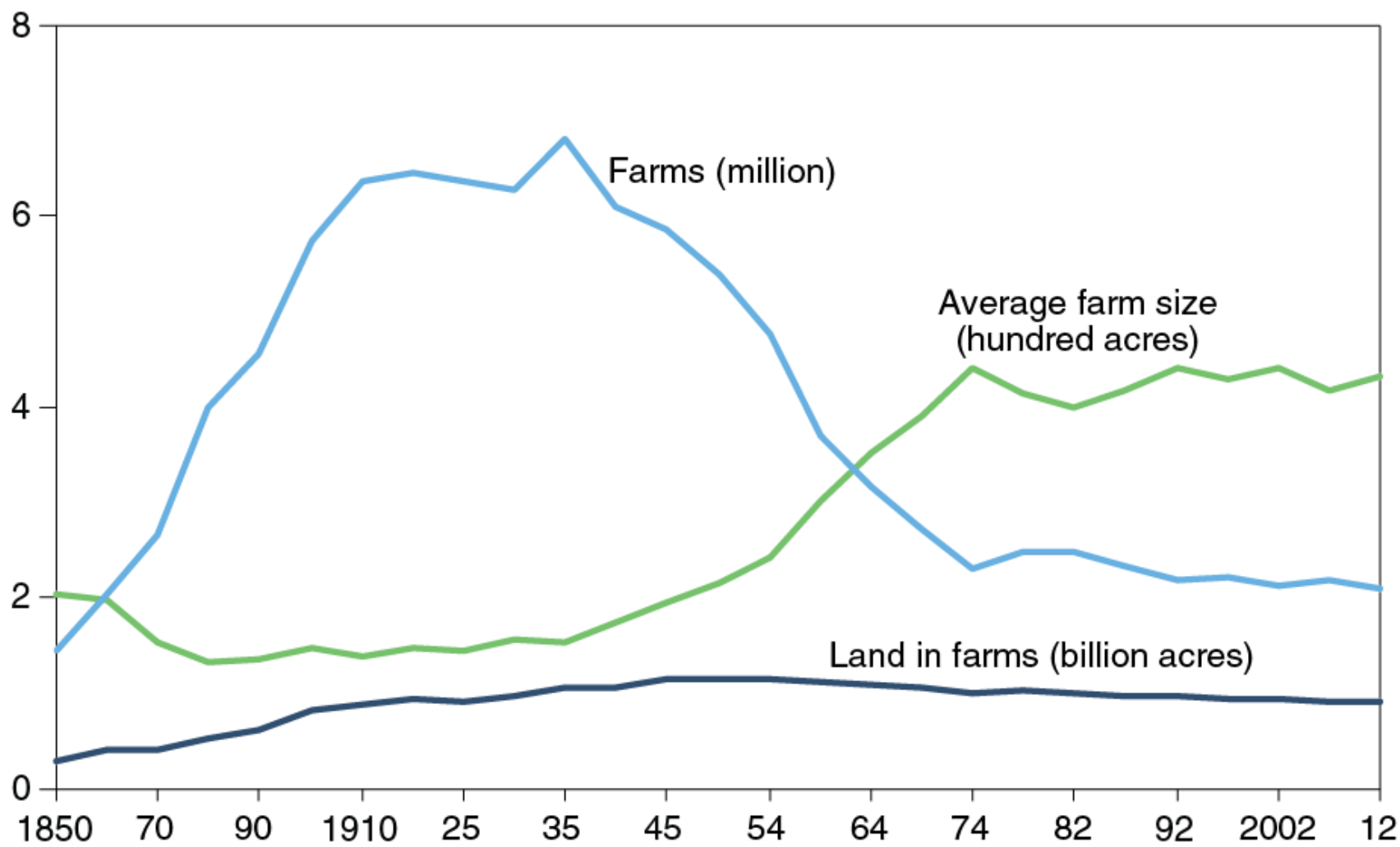
4 Applications

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



Source: USDA, Economic Research service using data from USDA, National Agricultural Statistics Service, Census of Agriculture.

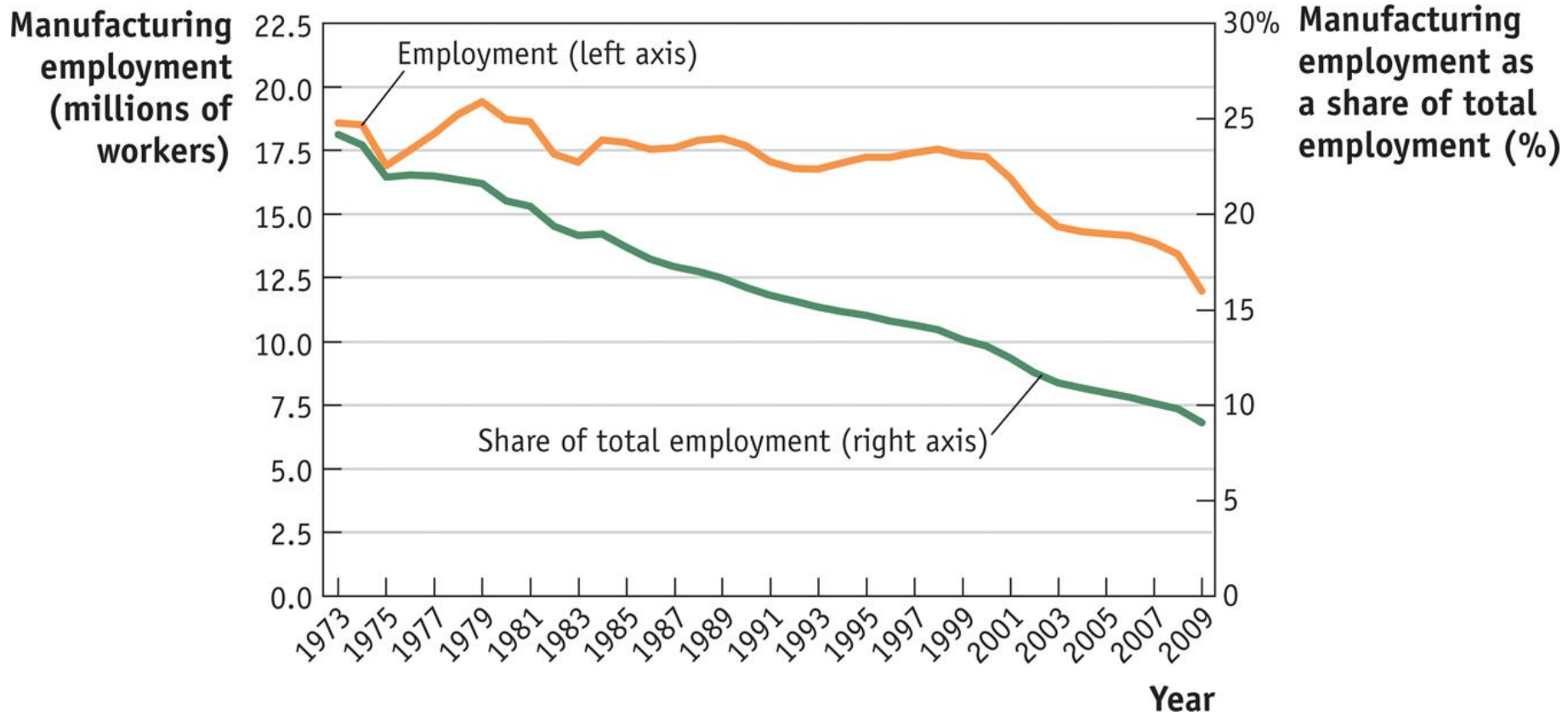
4 Applications

Illustrations:

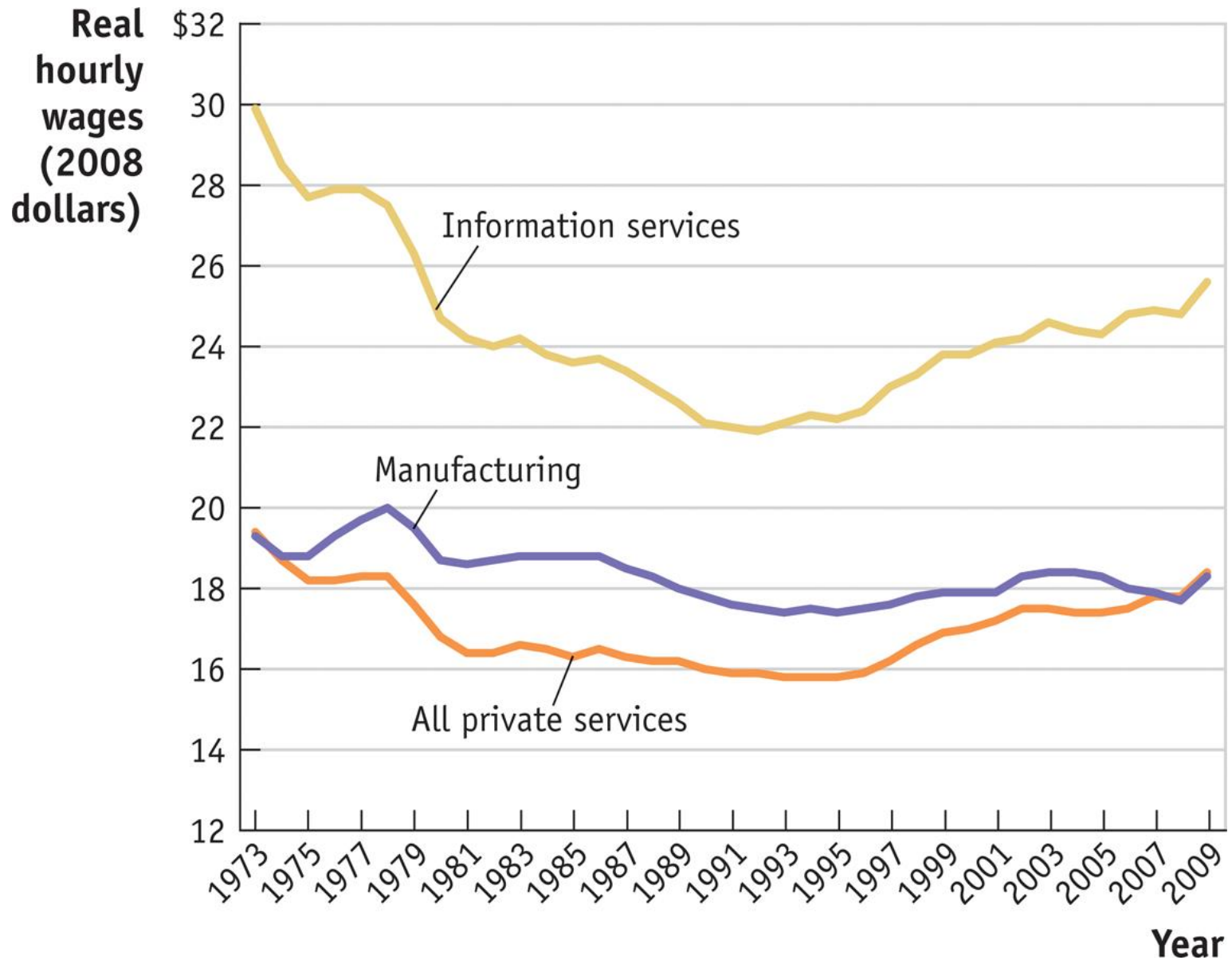
Better examples:

- Manufacturing as a whole:
 - Decreasing employment!
 - Lower wages
- Services:
 - Increasing employment
 - Increasing wages, especially since the early 90's

4 Applications



4 Applications



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:

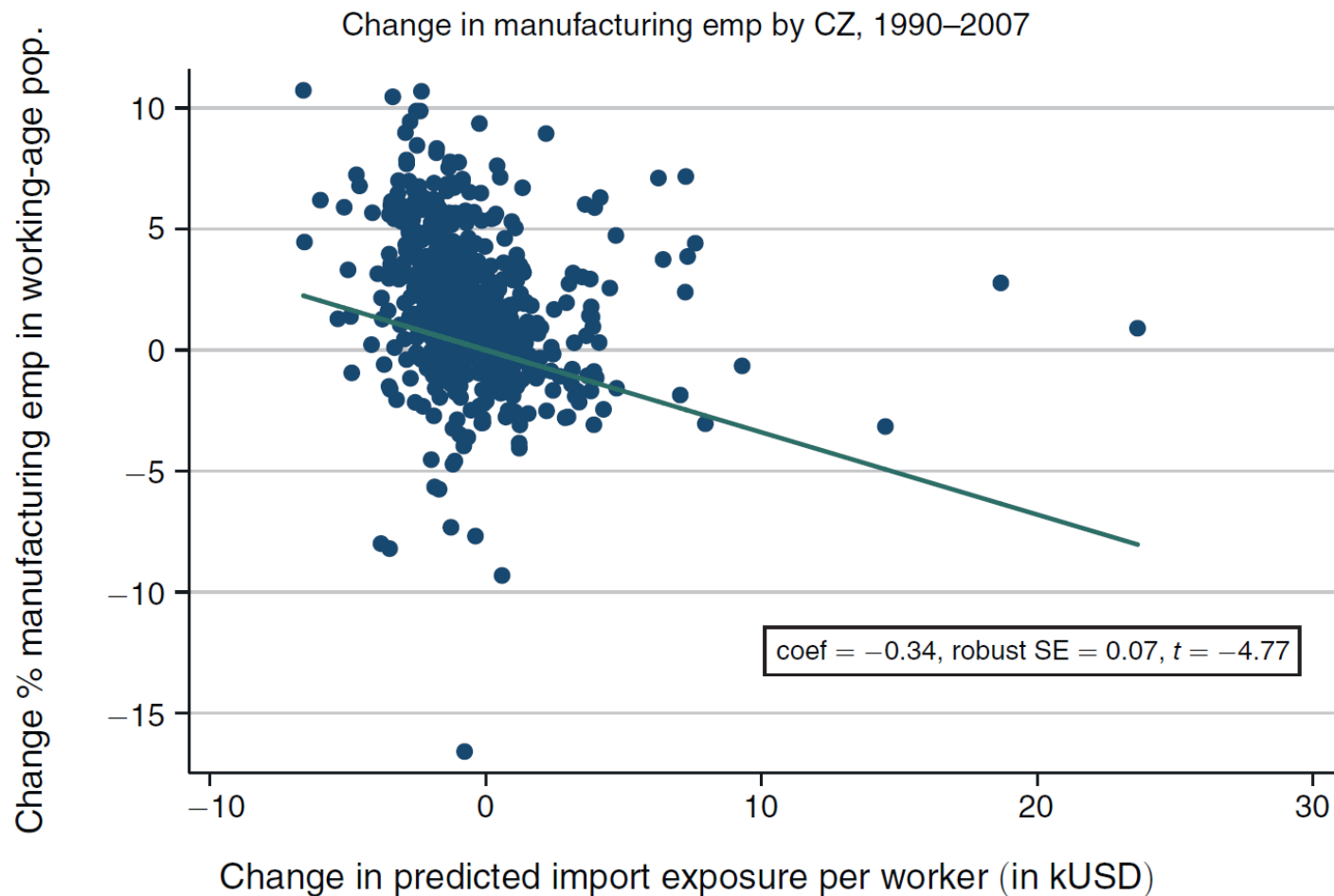


FIGURE 2. CHANGE IN IMPORT EXPOSURE PER WORKER AND DECLINE OF MANUFACTURING EMPLOYMENT

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

	I. Manufacturing sector			II. Nonmanufacturing		
	All workers (1)	College (2)	Noncollege (3)	All workers (4)	College (5)	Noncollege (6)
<i>Panel A. Log change in number of workers</i>						
(Δ imports from China to US)/worker	−4.231*** (1.047)	−3.992*** (1.181)	−4.493*** (1.243)	−0.274 (0.651)	0.291 (0.590)	−1.037 (0.764)
R^2	0.31	0.30	0.34	0.35	0.29	0.53
<i>Panel B. Change in average log wage</i>						
(Δ imports from China to US)/worker	0.150 (0.482)	0.458 (0.340)	−0.101 (0.369)	−0.761*** (0.260)	−0.743** (0.297)	−0.822*** (0.246)
R^2	0.22	0.21	0.33	0.60	0.54	0.51

Notes: $N = 1,444$ (722 CZs \times 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 wages in services sectors

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

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

Clicker question:

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

- Workers sometimes loose
- Land owners always loose
- 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.

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.

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

4 Applications

Clicker question:

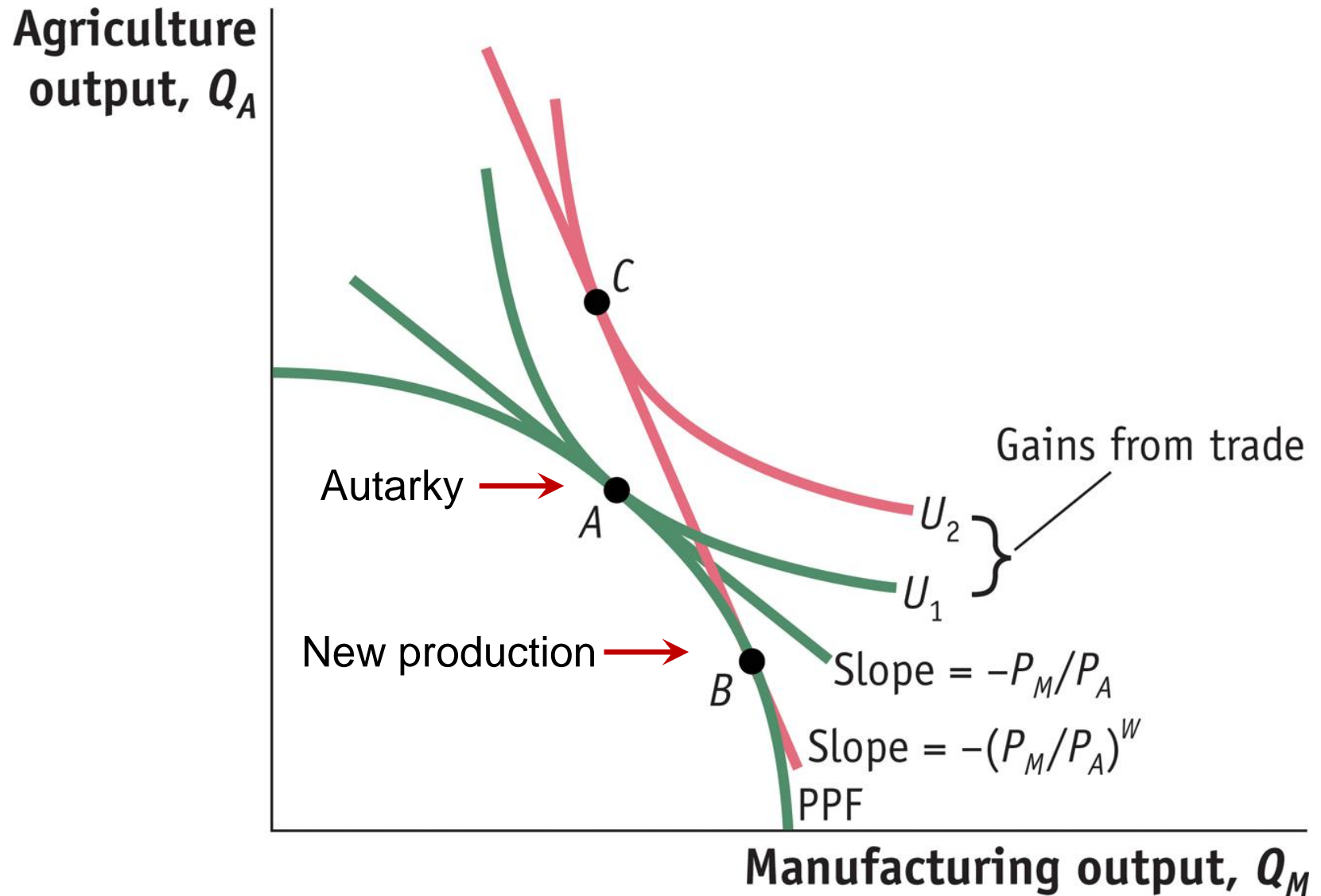
Why not a), b) or c)?

- 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



4 Applications

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 8—IMPORTS FROM CHINA AND CHANGE OF GOVERNMENT TRANSFER RECEIPTS
IN CZs, 1990–2007: 2SLS ESTIMATES

Dep vars: Ten-year equivalent log and dollar change of annual transfer receipts per capita (in log pts and US\$)

	Total individual transfers (1)	TAA benefits (2)	Unem- ployment benefits (3)	SSA retirement benefits (4)	SSA disability benefits (5)	Medical benefits (6)	Federal income assist (7)	Educ/ training assist (8)
<i>Panel A. Log change of transfer receipts per capita</i>								
(Δ imports from China to US)/worker	1.01*** (0.33)	14.41* (7.59)	3.46* (1.87)	0.72* (0.38)	1.96*** (0.69)	0.54 (0.49)	3.04*** (0.96)	2.78** (1.32)
R^2	0.57	0.28	0.48	0.36	0.32	0.27	0.54	0.33

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 lose
 - 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