3 Effect of trade on factor prices

IN THE SPECIFIC-FACTOR MODEL

Assume that the computer industry only use capital and that the shoe industry only use labor.
If the price of computers increases with trade:

a) Workers and capital owners all gain from trade but capital owners gain more

b) Workers and capital owners all gain from trade but workers gain more

c) Capital owners gain from trade and workers lose

d) Workers gain from trade and capital owners lose

3 Effect of trade on factor prices

IN THE SPECIFIC-FACTOR MODEL

We have shown (see chapter 3):

c) Capital owners gain from trade and workers lose

Now, today the key question is:

Does the same result hold when both industries use K and L and factors are mobile? (=HO model)

3 Effect of trade on factor prices

Stolper-Samuelson Theorem

Within the Heckscher-Ohlin framework:

What is the effect of trade on wages?
(adjusting for prices, i.e. looking at welfare)

What is the effect of trade on the rental rate?

What is the effect of trade on the wage/rental rate ratio?
    Focus first on wage/rental rate ratio
    Focus first on relative demand & supply of labor/capital

3 Effect of trade on factor prices

Relative demand for Capital and Labor:

What is the relative **supply** of labor at Home?

What is the relative **demand** for labor at Home?

$$\underbrace{\frac{\bar{L}}{\bar{K}}}_{\substack{\textbf{Relative} \\ \textbf{supply}}} = \frac{L_C + L_S}{\bar{K}} = \underbrace{\frac{L_C}{K_C} \cdot \left(\frac{K_C}{\bar{K}}\right) + \frac{L_S}{K_S}\left(\frac{K_S}{\bar{K}}\right)}_{\substack{\textbf{Relative} \\ \textbf{demand}}}$$

3 Effect of trade on factor prices

Relative demand for Capital and Labor:

$$\underbrace{\frac{\bar{L}}{\bar{K}}}_{\substack{\text{Relative} \\ \text{supply}}} = \frac{L_C + L_S}{\bar{K}} = \underbrace{\frac{L_C}{K_C} \cdot \left(\frac{K_C}{\bar{K}}\right) + \frac{L_S}{K_S}\left(\frac{K_S}{\bar{K}}\right)}_{\substack{\text{Relative} \\ \text{demand}}}$$

Relative **demand** for labor determined by:

- Labor intensity in each industry: L_C/K_C and L_S/K_S

- Industry shares in capital use: K_C/K and K_S/K

➔ Relative demand for labor = Average of labor intensies, weighted by the share of each industry in capital use.
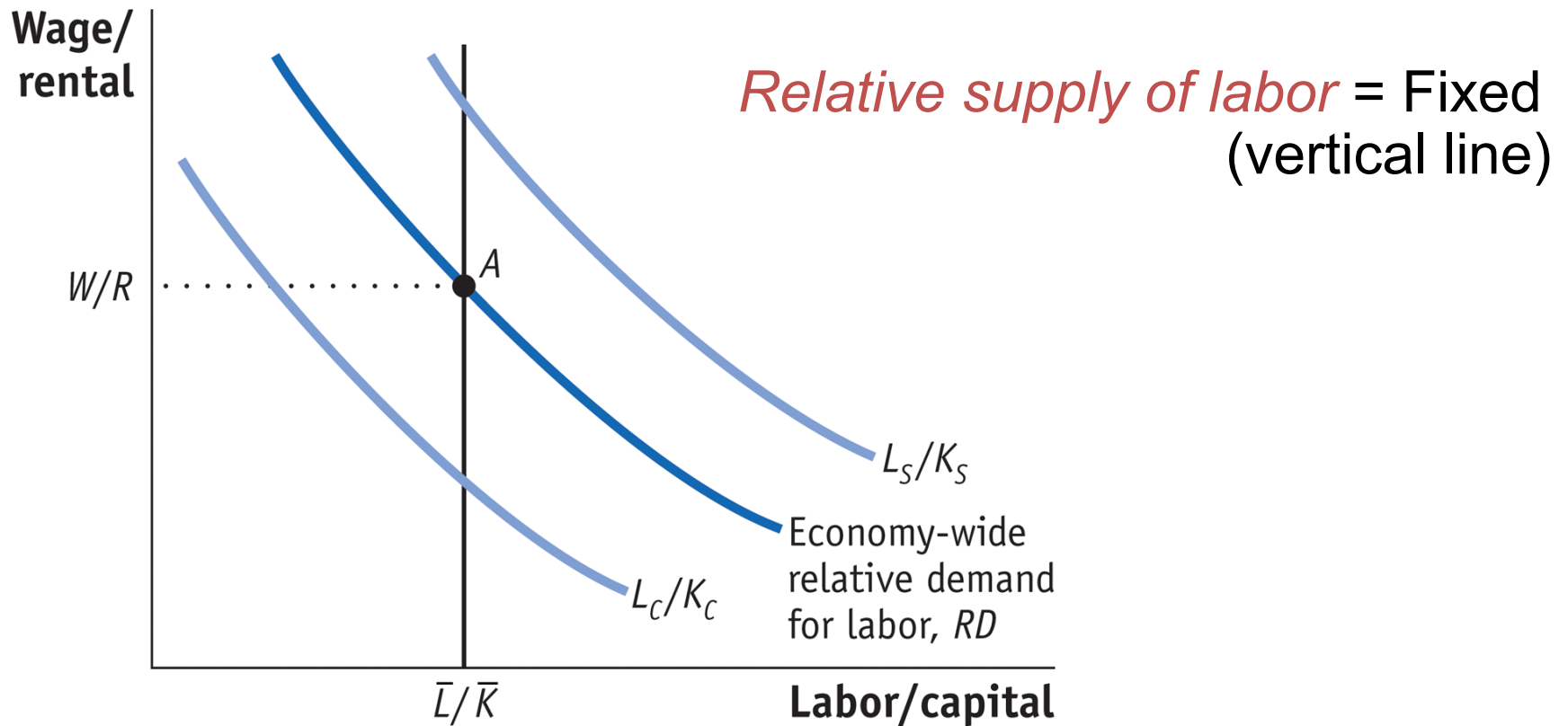
3 Effect of trade on factor prices

Relative demand for Capital and Labor:

Relative demand for labor = Average of labor intensities, weighted by the share of each industry in capital use.
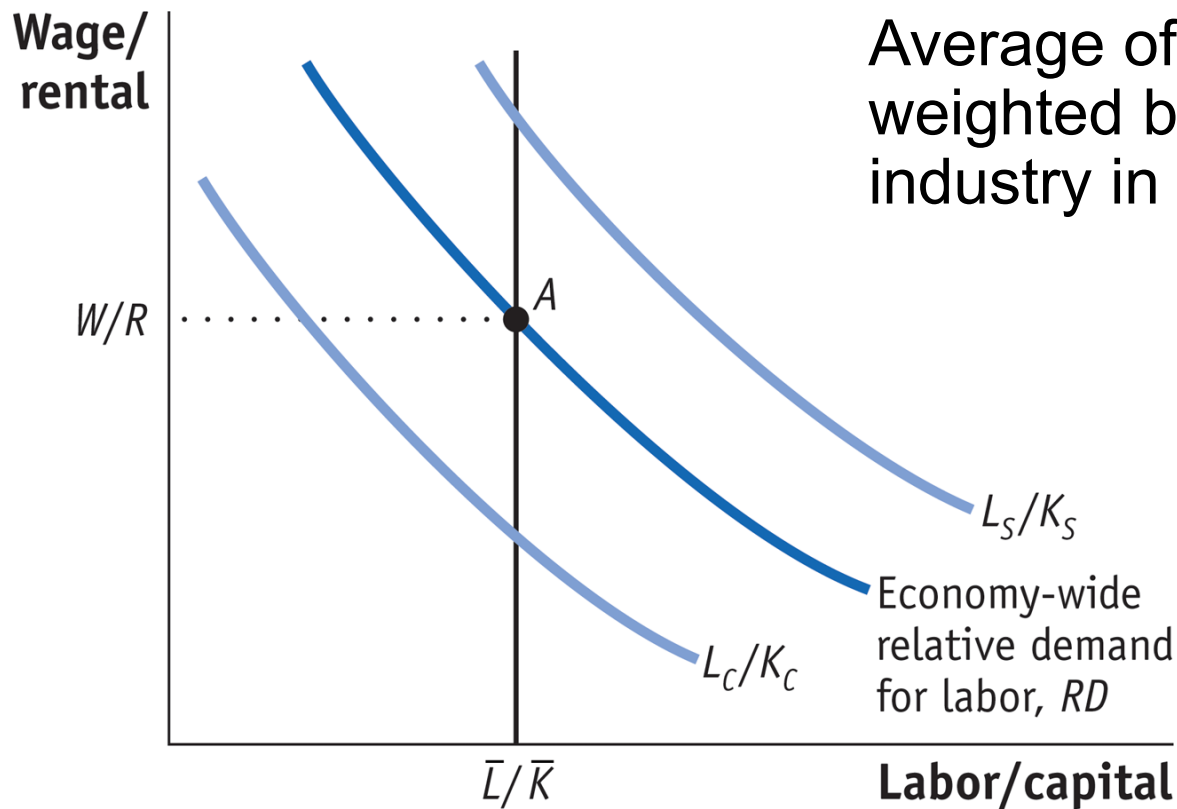
3- Effect of trade on factor prices
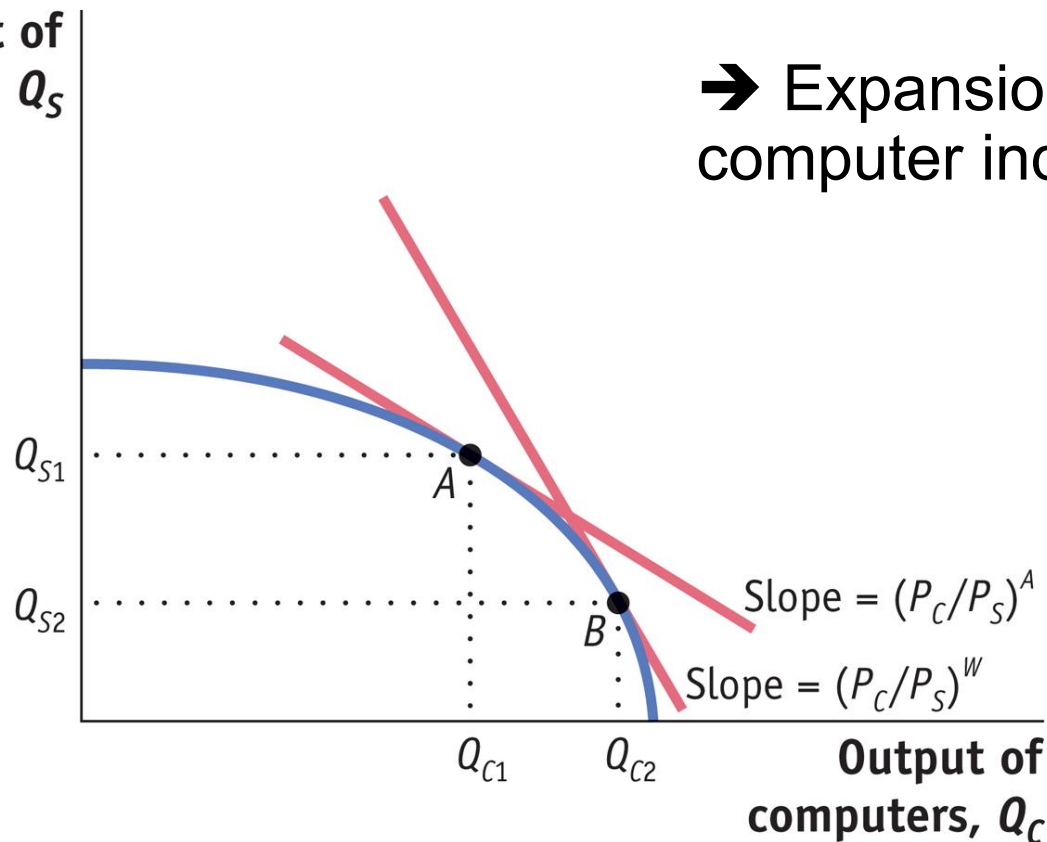
Relative supply of Capital and Labor:

Relative supply of labor = Fixed (vertical line)

3- Effect of trade on factor prices

Effect of trade
(Effect of an increase in the Relative Price of Computers)

➔ Expansion of the computer industry (at Home)

Output of shoes, Q_S

Q_{S1}

A

Q_{S2}

B

Slope $= (P_C/P_S)^A$

Slope $= (P_C/P_S)^W$

Q_{C1} Q_{C2}

Output of computers, Q_C

3- Effect of trade on factor prices

Relative demand for Capital and Labor:

$$\underbrace{\frac{\overline{L}}{\overline{K}}}_{\substack{\text{Relative} \\ \text{supply}}} = \frac{L_C + L_S}{\overline{K}} = \underbrace{\frac{L_C}{K_C} \cdot \left(\frac{K_C}{\overline{K}}\right) + \frac{L_S}{K_S}\left(\frac{K_S}{\overline{K}}\right)}_{\substack{\text{Relative} \\ \text{demand}}}$$

A shift towards the computer industry leads to:
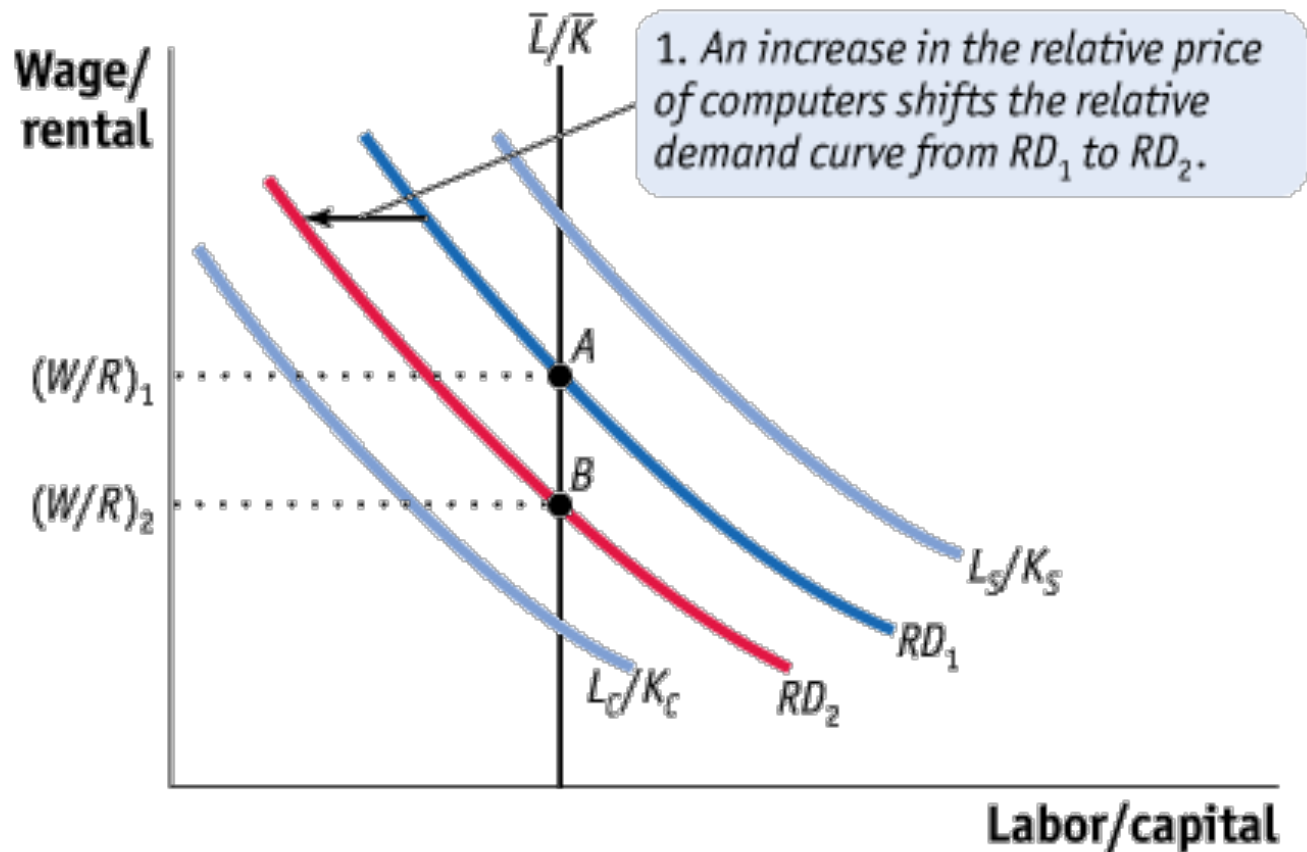
- An increase in computer industry capital share K_C/K

- An decrease in shoe industry capital share K_S/K

  Decrease in relative demand for labor

3- Effect of trade on factor prices

Effect of Trade
(Effect of an increase in the Relative Price of Computers)

1. *An increase in the relative price of computers shifts the relative demand curve from RD_1 to RD_2.*
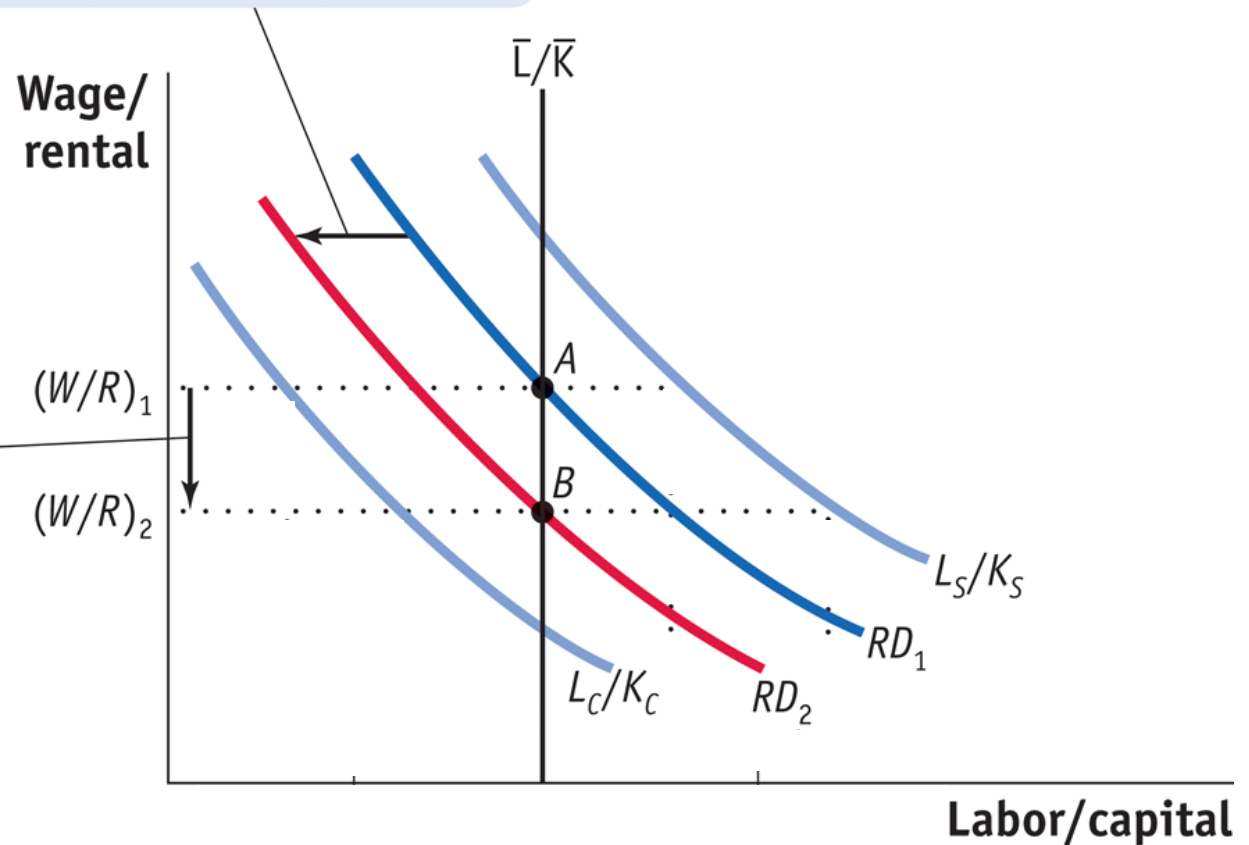
3- Effect of trade on factor prices

Effect of Trade
(Effect of an increase in the Relative Price of Computers)

1. An increase in the relative price of computers shifts the relative demand curve from RD_1 to RD_2.

2. The relative wage decreases from $(W/R)_1$ to $(W/R)_2$.

$\overline{L}/\overline{K}$

Wage/rental

$(W/R)_1$

$(W/R)_2$

A

B

L_S/K_S

RD_1

L_C/K_C

RD_2

Labor/capital

3- Effect of trade on factor prices

Effect of trade

At Home, opening to trade induces:

- An increase in the relative price of computers

- An expansion of the computer industry

- A decrease of the demand for labor

- A decrease in the wage/rental-rate ratio

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of <u>shoes</u> increases with trade:

a) Capital owners gain relatively more than workers

b) Workers gain relatively more than capital owners

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of <u>shoes</u> increases with trade:

b) Workers gain relatively more than capital owners

Because in that case: W/R increases!

3- Effect of trade on factor prices

What's next?

- We have yet to examine whether workers actually gain or lose from trade.

- As for the Specific-Factor Model, we examine how MPK and MPL evolve.

- As for the Specific-Factor Model, this depends crucially on how L_C/K_C and L_S/K_S change in each industry.

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

a) Labor intensity increases in the Shoe industry and decreases in the Computer industry

b) Labor intensity decreases in the Shoe industry and increases in the Computer industry

c) Labor intensity increases in both industries

d) Labor intensity decreases in both industries

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

c) Labor intensity increases in both industries

Since the relative price of capital R/W increases, firms in ALL industries try to hire more workers relative to capital.

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

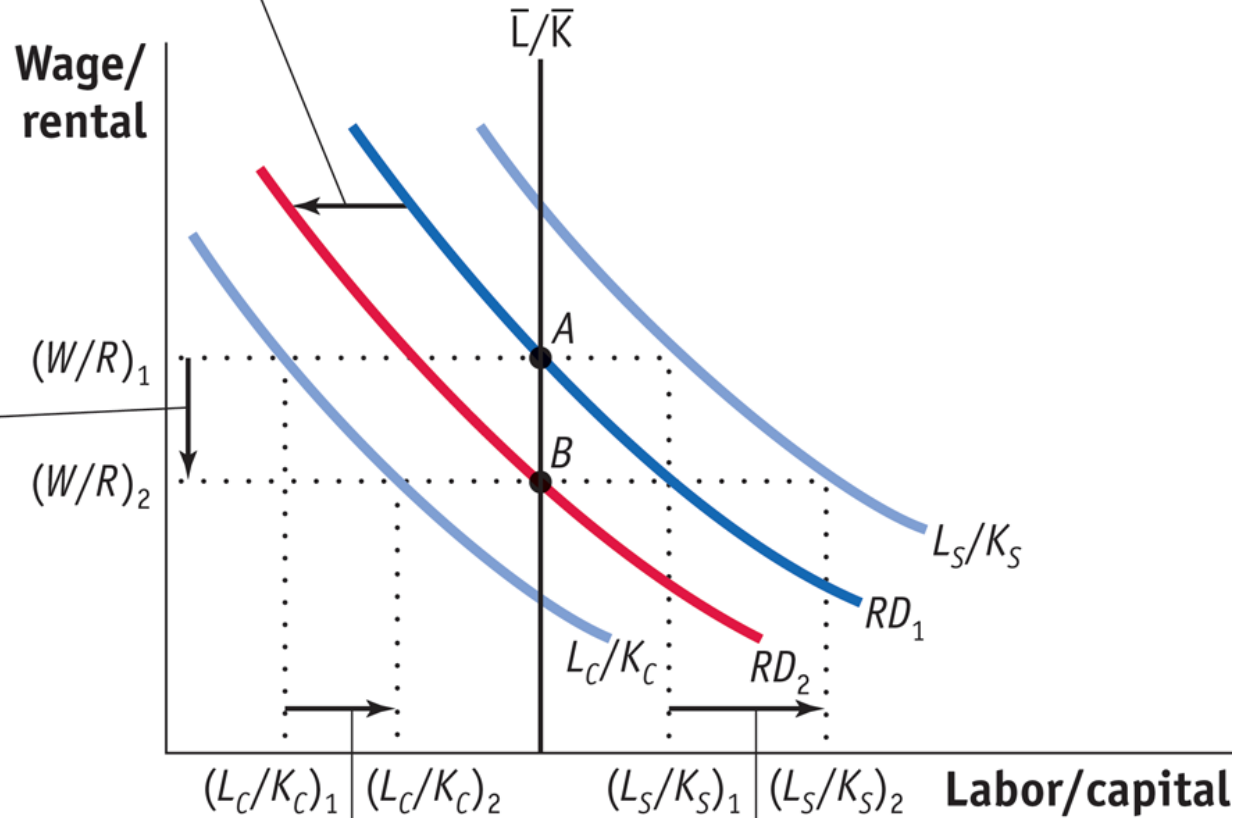c) Labor intensity increases in both industries

Since the relative price of capital R/W increases, firms in ALL industries try to hire more workers relative to capital.

On the graph:

→ Moving to the right for the demand curve in each industry (light-blue curves).

- Notice that the curves specific to each industry do not move, it's just a movement along these curves.

1. An increase in the relative price of computers shifts the relative demand curve from RD_1 to RD_2.

$\overline{L}/\overline{K}$

Wage/ rental

$(W/R)_1$

2. The relative wage decreases from $(W/R)_1$ to $(W/R)_2$.

$(W/R)_2$

A

B

L_S/K_S

RD_1

L_C/K_C

RD_2

$(L_C/K_C)_1$ $(L_C/K_C)_2$

$(L_S/K_S)_1$ $(L_S/K_S)_2$ **Labor/capital**

3. At the new relative wage, the labor/capital ratio in each industry increases.

3- Effect of trade on factor prices

Effect of trade

At Home, opening to trade induces:

- An increase in the relative price of computers

- An expansion of the computer industry

- A decrease of the demand for labor

- A decrease in the wage/rental-rate ratio

- *increase in labor intensity* L_C/K_C *and* L_S/K_S *in each industry*

3- Effect of trade on factor prices

Effect of trade

$$\frac{\bar{L}}{\bar{K}} = \frac{L_C + L_S}{\bar{K}} = \frac{L_C}{K_C} \cdot \left(\frac{K_C}{\bar{K}}\right) + \frac{L_S}{K_S}\left(\frac{K_S}{\bar{K}}\right)$$

$\uparrow$ $\uparrow$ $\uparrow$ $\downarrow$

Relative supply: **No change**

Relative demand No change in total

- Shift of K towards computers implies a increase in labor intensity in each industry

- On aggregate, the relative demand remains unchanged

3- Effect of trade on factor prices

Effect of trade on MPK and MPL?

$MPK_C \uparrow$ *because* L_C/K_C increases
(there are more workers to operate machines in the computer industry)

$MPK_S \uparrow$ *because* L_S/K_S increases
(there are also more workers to operate machines in the shoe industry)

Conversely, MPL decreases in both industries

3- Effect of trade on factor prices

We answered:

- What is the effect of trade on the wage/rental rate ratio?

Now:

- What is the effect of trade on the rental rate?
   (in real terms, i.e. in terms of welfare)

- What is the effect of trade on wages?
   (in real terms, i.e. in terms of welfare)

3- Effect of trade on factor prices

Effect on rental rate?

What about the rental rate? Welfare of K owners?

$$R = P_C \bullet MPK_C \quad and \quad R = P_S \bullet MPK_S$$

Real rate (compared to each price):

$R/P_C = MPK_C \uparrow$ *because* L_C/K_C increases
(there are more workers to operate machines in the computer industry)

3- Effect of trade on factor prices

Effect on rental rate?

What about the rental rate? Welfare of K owners?

$R = P_C \cdot MPK_C$ and $R = P_S \cdot MPK_S$

Real rate (compared to each price):

$R/P_C = MPK_C \uparrow$ because L_C/K_C increases

$R/P_S = MPK_S \uparrow$ because L_S/K_S increases

➔ **The rental rate increases faster than any price in the Home country**

3- Effect of trade on factor prices

Effect on wages?

What about wages? Welfare of workers?

$W = P_C \cdot MPL_C$ and $W = P_S \cdot MPL_S$

"Real" wage (compared to each price):

$W/P_C = MPL_C \downarrow$ because L_C/K_C increases

$W/P_S = MPL_S \downarrow$ because L_S/K_S increases

➔ **Wages decreases faster than any price in the Home country**

3- Effect of trade on factor prices

Determination of the Real Wage and Real Rental

Stolper-Samuelson Theorem:

If the Home country opens to trade, the price of computers increases (compared to the price of shoes) and:

$$\frac{\Delta W}{W} < \frac{\Delta P_S}{P_S} < \frac{\Delta P_c}{P_c} < \frac{\Delta R}{R}$$

3- Effect of trade on factor prices

Determination of the Real Wage and Real Rental

Stolper-Samuelson Theorem:

In the long run, when all factors are mobile, an increase in the relative price of a good will increase the real earnings of the factor used intensively in the production of that good and _decrease_ the real earnings of the other factor.

PS: *regardless of which industry employs this factor*
(HO model is about the long-run: factors are mobile)

3- Effect of trade on factor prices

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

c) Capital owners gain from trade and workers lose

Heckscher-Ohlin: Summary from Chapter 4

- We can generate trade by differences in endowments, even if technologies are the same

- Heckscher-Ohlin Theorem: if a country is abundant in a factor, it should exports in industries that are relatively intensive in this factor.

- The data support HO theorem only when also incorporate differences in productivity.

- Stolper-Samuelson theorem: An increase in the price of a good generates an increase in the real earning of the factor used intensively in the production of that good, and should _decrease_ the real earning of the other factor

4- Trade and wage inequality

Skilled vs. unskilled labor

As mentioned earlier, we can reinterpret HO model with two factors of production:

- Skilled labor, e.g. college-educated workers *(instead of K)* vs.
- Unskilled labor *(instead of L)*

HO model can be used to examine how trade affects wage inequality between skilled and unskilled workers

(Use HO model after replacing Capital by skilled workers, and labor by unskilled worked)

4- Trade and wage inequality

Some vocabulary:

"Skill premium"

Ratio of the wage of skilled workers (college educated) over the wage of unskilled workers

(= Same as R/W in HO model with capital vs. labor)

4- Trade and wage inequality

Skilled vs. unskilled labor

Suppose that Shoe production is intensive in unskilled labor while Computer production is intensive in skilled labor

Suppose that Home is abundant in skilled labor and Foreign in unskilled labor

What happens when Home and Foreign start to trade?

- Shoe production is intensive in unskilled labor while Computer production is intensive in skilled labor
- Home is abundant in skilled labor and Foreign in unskilled labor

What happens as countries go from autarky to free trade?

a) The skill premium increases in Foreign and Home

b) The skill premium decreases in Foreign and Home

c) Skill prem' increases in Foreign, decreases in Home

d) Skill prem' decreases in Foreign, increases in Home

4- Trade and wage inequality

What happens when Home and Foreign start to trade?

- Since Home is relatively <u>abundant</u> in skilled labor, Home has a lower relative price of computers in Autarky (computers are <u>intensive</u> in skilled labor)

- As Home opens to trade, the relative price of computers goes up

- As the relative price of computers go up, Home tends to produce more computers and export computers

4- Trade and wage inequality

What happens when Home and Foreign start to trade?

- Since Home is relatively <u>abundant</u> in skilled labor, Home has a lower relative price of computers in Autarky (computers are <u>intensive</u> in skilled labor)

- As Home opens to trade, the relative price of computers goes up

- As the relative price of computers go up, Home tends to produce more computers and export computers

- Stolper-Samuelson Theorem implies that the relative wage of skilled workers (i.e. the skill premium) should increase in Home

4- Trade and wage inequality

And what happens to workers in Foreign?

- Since Foreign is relatively <u>abundant</u> in unskilled labor, the relative price of shoes in Foreign goes up and Foreign tends to export shoes.

4- Trade and wage inequality

And what happens to workers in Foreign?

- Since Foreign is relatively <u>abundant</u> in unskilled labor, the relative price of shoes in Foreign goes up and Foreign tends to export shoes.

- Stolper-Samuelson Theorem implies that the relative wage of skilled workers (i.e. the skill premium) should Decrease in Foreign

4- Trade and wage inequality

Predictions

Do these predictions fit in with the data?

- First, looking at pro-trade views

- Next, looking directly at the wages

4- Trade and wage inequality

Application:

Stolper-Samuelson and Political Views on Trade

- High-skilled workers in skill abundant (i.e., rich) countries should favor trade

- Low-skilled workers in skill abundant (i.e., rich) countries should be against trade

- High-skilled workers in unskilled-labor abundant (i.e., poor) countries should be against trade

- Low-skilled workers in unskilled-labor abundant (i.e., poor) countries should favor trade
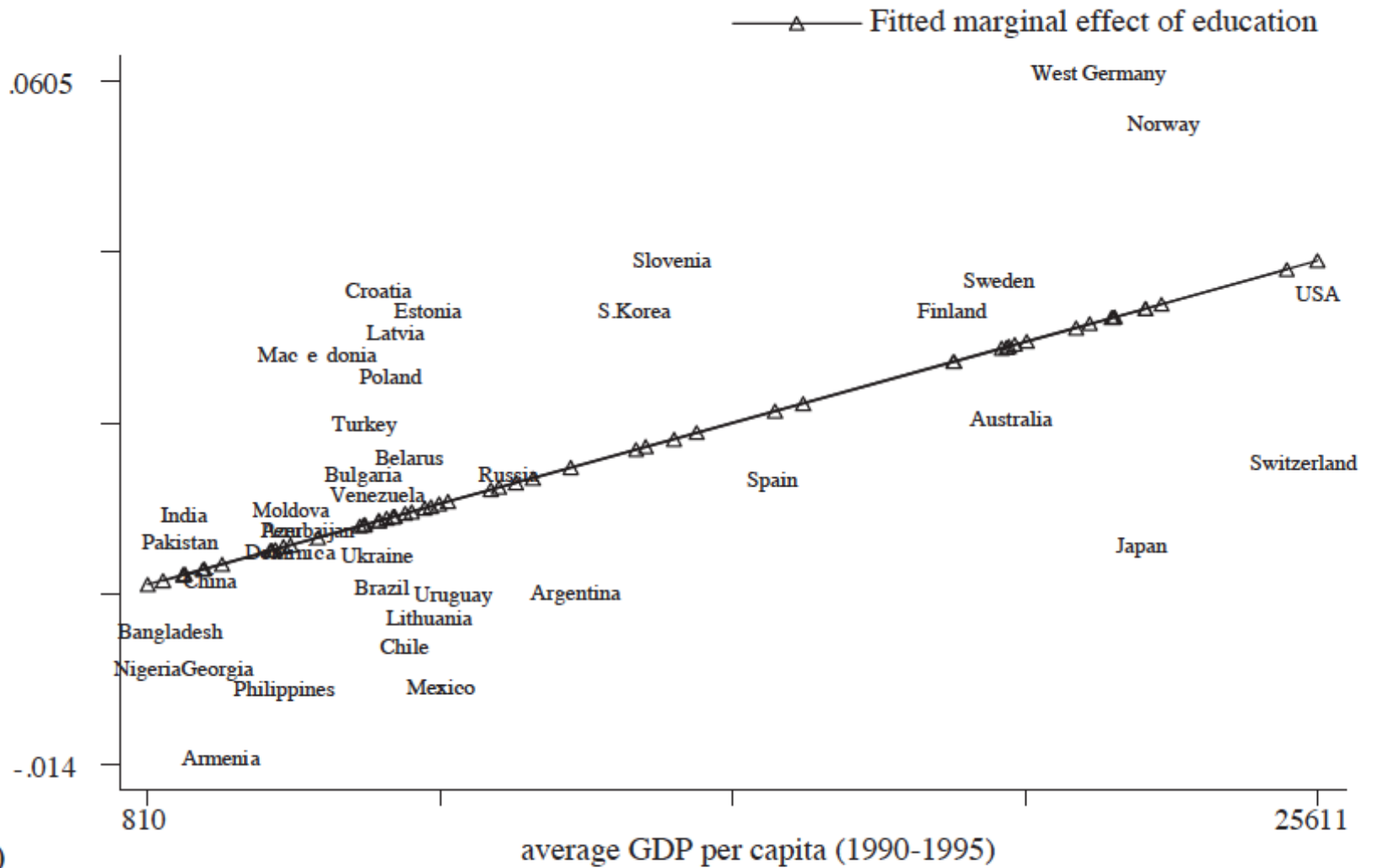
Fig. 2. Relationship between per-capita GDP and the estimated marginal effect of: (a) education on pro-trade attitudes (ISSP data set) and, (b) occupational skill on pro-trade attitudes (WVS data set).

4- Trade and wage inequality

Application:

Stolper-Samuelson and Political Views on Trade

- Data: surveys asking people whether they favor trade and relate to their education across countries (Mayda and Rodrik, EER 2005)

- Opinions are in line with Stolper-Samuelson:

→ Higher education more likely to lead to pro-trade views in skill-abundant countries

4- Trade and wage inequality

Predictions

Now, looking directly at the skill premium:

- Does the skill premium <u>increase</u> with trade in <u>richer</u> countries with relatively more skilled workers?

- Does the skill premium <u>decrease</u> with trade in <u>poorer</u> countries with relatively fewer skilled workers?

NOTE: this is about relative wages *within* each country

4- Trade and wage inequality

US Data

Increase in the relative wage of skilled workers?

4- Trade and wage inequality

Relative wage of skilled workers in US manufacturing:
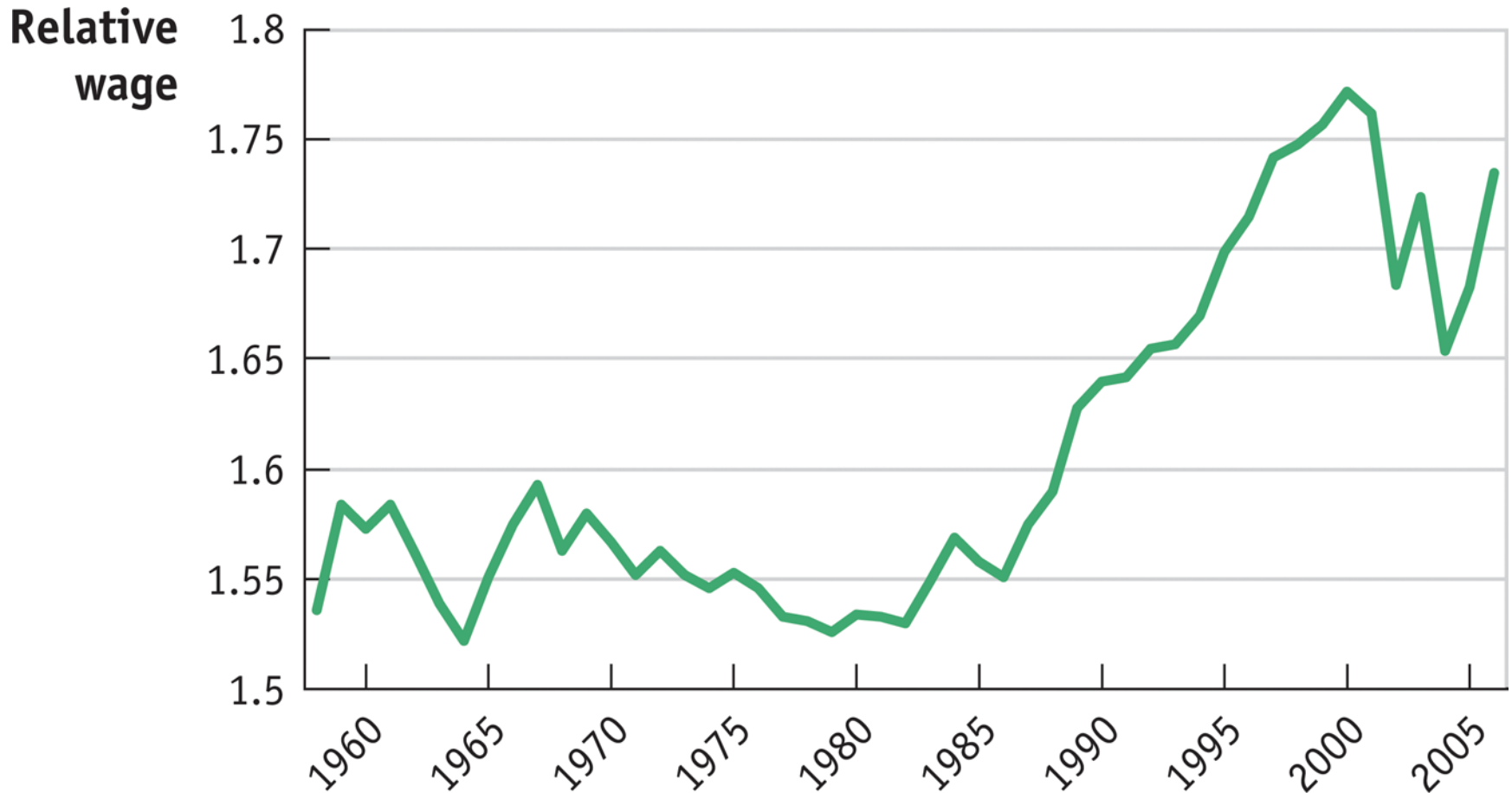
4- Trade and wage inequality

US Data

How do we know it's not due to a change in the supply of skilled vs. unskilled workers?

(i.e. a change in college education)

→ Look at evolution of relative employment

Reminder:

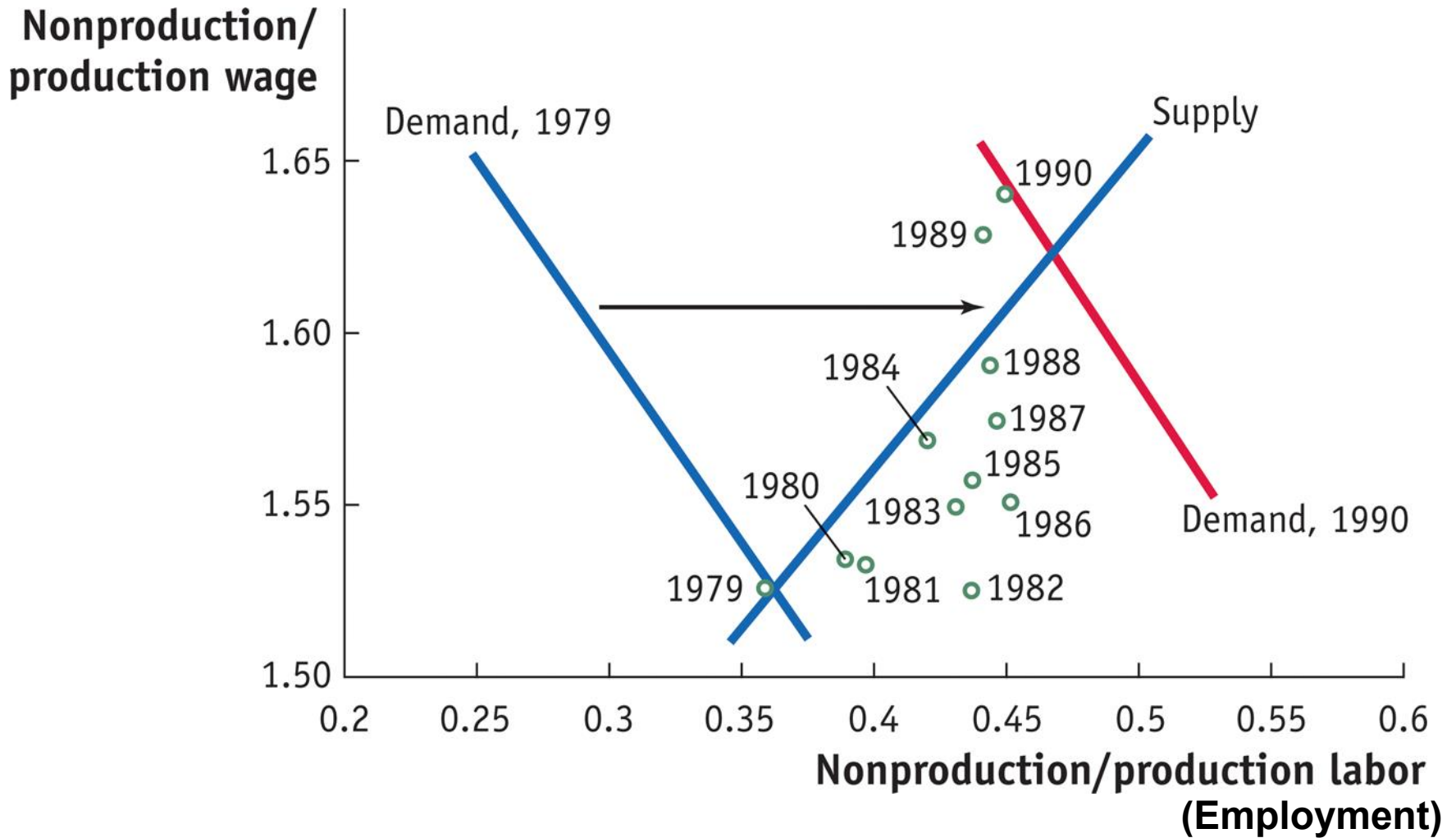Labor demand is determined by firms and industry specialization

Labor supply is determined by workers choice and education

4- Trade and wage inequality

Relative employment of skilled workers in US manufacturing:
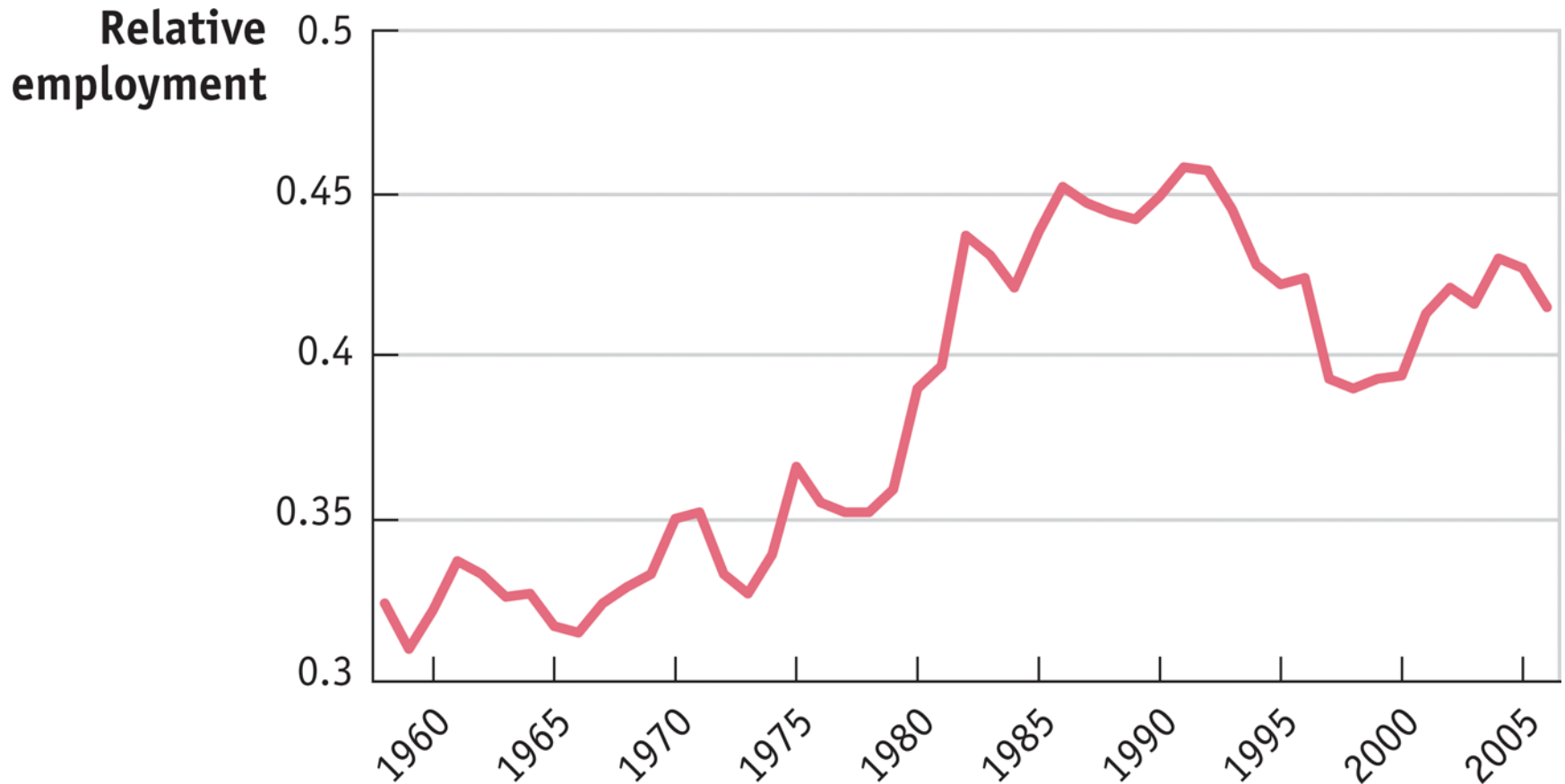
4- Trade and wage inequality

4- Trade and wage inequality

US Data

How do we know it's not due to a change in the supply of skilled vs. unskilled workers?

(i.e. a change in college education)

A <u>decrease</u> in the relative <u>supply</u> of skilled workers induces:

- An increase in the skilled <u>premium</u>
- But a decrease in relative skilled labor <u>employment</u>

4- Trade and wage inequality

US Data

How do we know it's not due to a change in the supply of skilled vs. unskilled workers?

(i.e. a change in college education)

An <u>increase</u> in relative <u>demand</u> of skilled workers induces:

- An increase in the skilled <u>premium</u>
- And a increase in relative skilled labor <u>employment</u>

= what we observe!!

4- Trade and wage inequality

US Data

Increase in the relative wage of skilled workers:

Hanson Feenstra (1996) have shown that trade can explain about 1/3rd of skill premium increase in the US

Other channels:

- *Explained by skilled-biased technological change*
(computers require skills and favor workers with college education)

- *Rents from capital*

4- Trade and wage inequality

Mexican Data

Increase in the relative wage of skilled workers?

Not as sharp, but *increase* in skill premium after 1985

4- Trade and wage inequality

Relative wage of skilled workers in Mexican manufacturing:
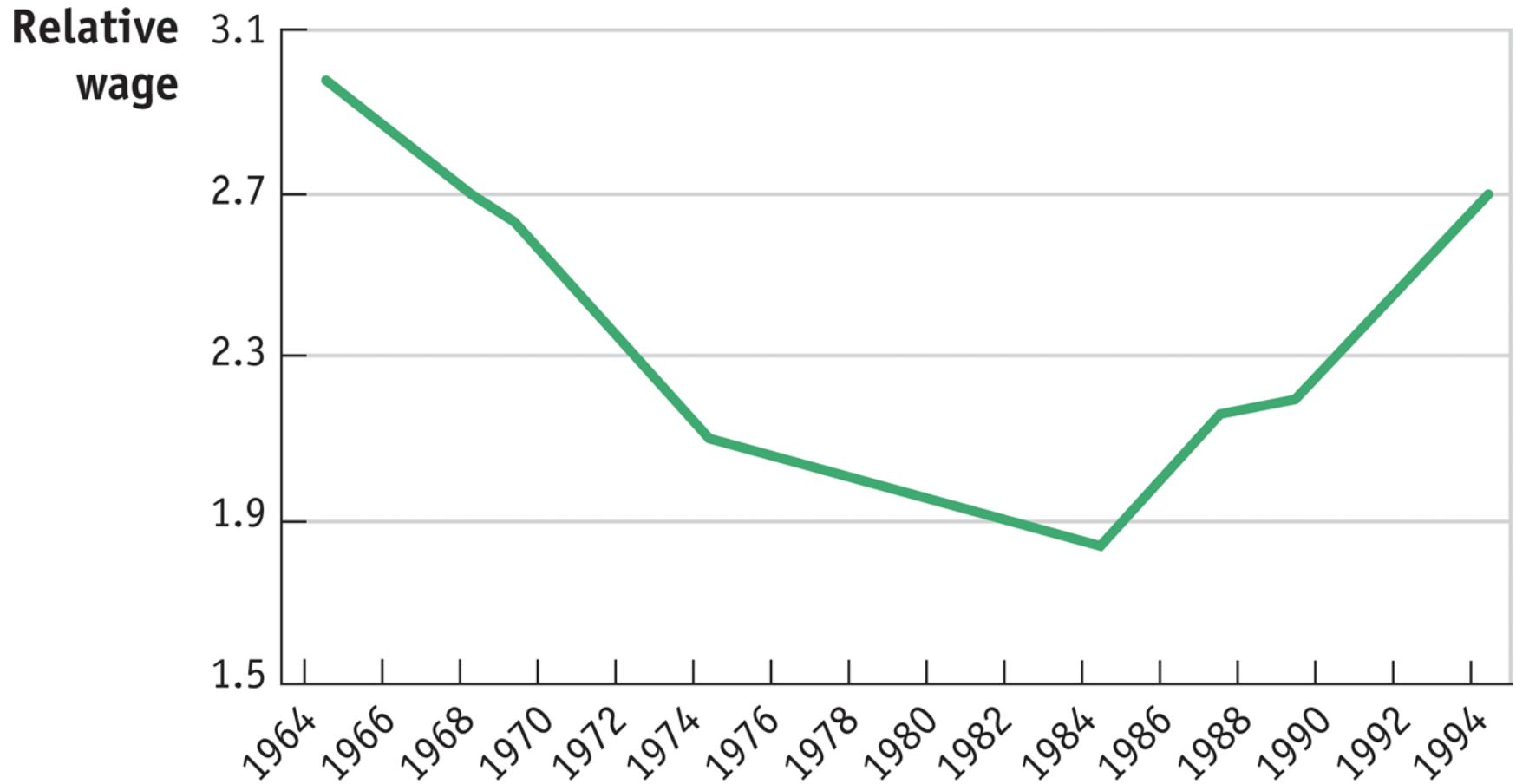
4- Trade and wage inequality

Other countries

Increase in the relative wage of skilled workers?

4- Trade and wage inequality

Other countries

Increase in the relative wage of skilled workers?

→ Yes, for most of them

Argentina	2.1%	1990-1999	college/high school wage ratio
Austria	-9.9%	1990-2005	college/high school wage ratio
Brazil	5.6%	1996-2007	non-prod./prod. workers wage ratio
Canada	-1.2%	1990-2004	college/high school wage ratio
Chile	-5.0%	1990-2000	college/high school wage ratio
China	40.2%	1992-2006	college/high school wage ratio
Colombia	26.4%	1990-2000	non-prod./prod. workers wage ratio
Denmark	-2.3%	1990-2005	college/high school wage ratio
Finland	1.4%	1990-2005	college/high school wage ratio
France	-16.8%	1990-2005	college/high school wage ratio
Germany	14.4%	1990-2005	college/high school wage ratio
Greece	-2.4%	1990-2005	college/high school wage ratio
India	11.9%	1987-2004	college/high school wage ratio
Italy	29.8%	1990-2005	college/high school wage ratio
Japan	-3.4%	1990-2005	college/high school wage ratio
Korea	-6.6%	1990-2005	college/high school wage ratio
Mexico	12.5%	1990-2001	non-prod./prod. workers wage ratio
Peru	23.9%	1994-2000	non-prod./prod. workers wage ratio
Portugal	12.3%	1992-2005	college/high school wage ratio
Philippines	5.0%	1988-2006	college/high school wage ratio
Spain	8.2%	1990-2005	college/high school wage ratio
Sweden	9.0%	1990-2002	college/high school wage ratio
Thailand	17.2%	1990-2004	college/high school wage ratio
United Kingdom	2.0%	1990-2005	college/high school wage ratio
United States	3.1%	1990-2007	non-prod./prod. workers wage ratio

4- Trade and wage inequality

Other countries

Increase in the relative wage of skilled workers?

→ Yes, for most of them

→ Not very consistent with HO model for poor countries

*(see ch. 7 for theory that can explain an increase in
skill premium in both types of countries)*

4- Trade and wage inequality

World Data

Income distribution across the world

Beyond countries: has inequality decreased globally?

Trade should induce an increase in top incomes but also an increase in incomes at the bottom of the distribution

Figure 2: The global distribution of income over time
logarithmic scale, population-weighted
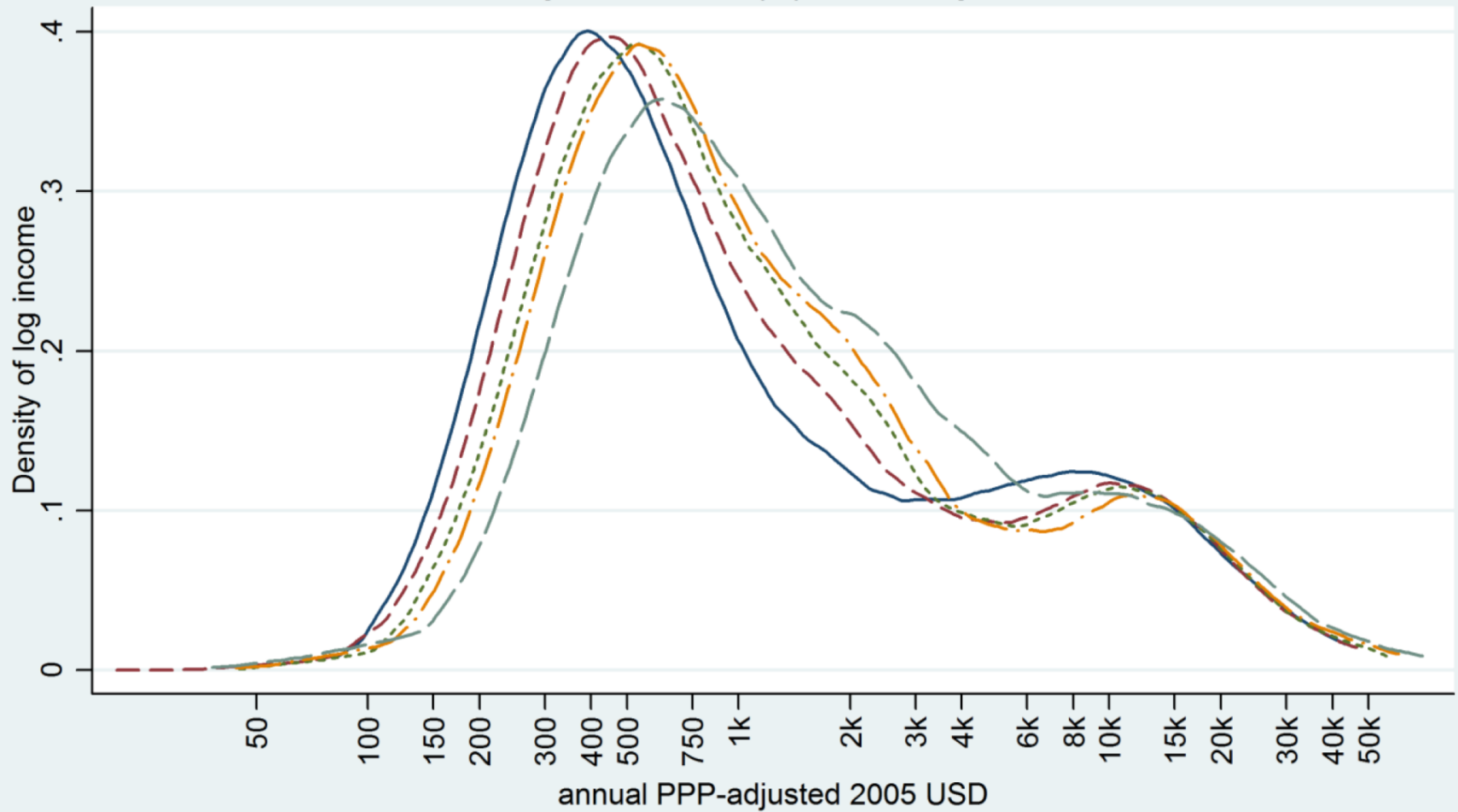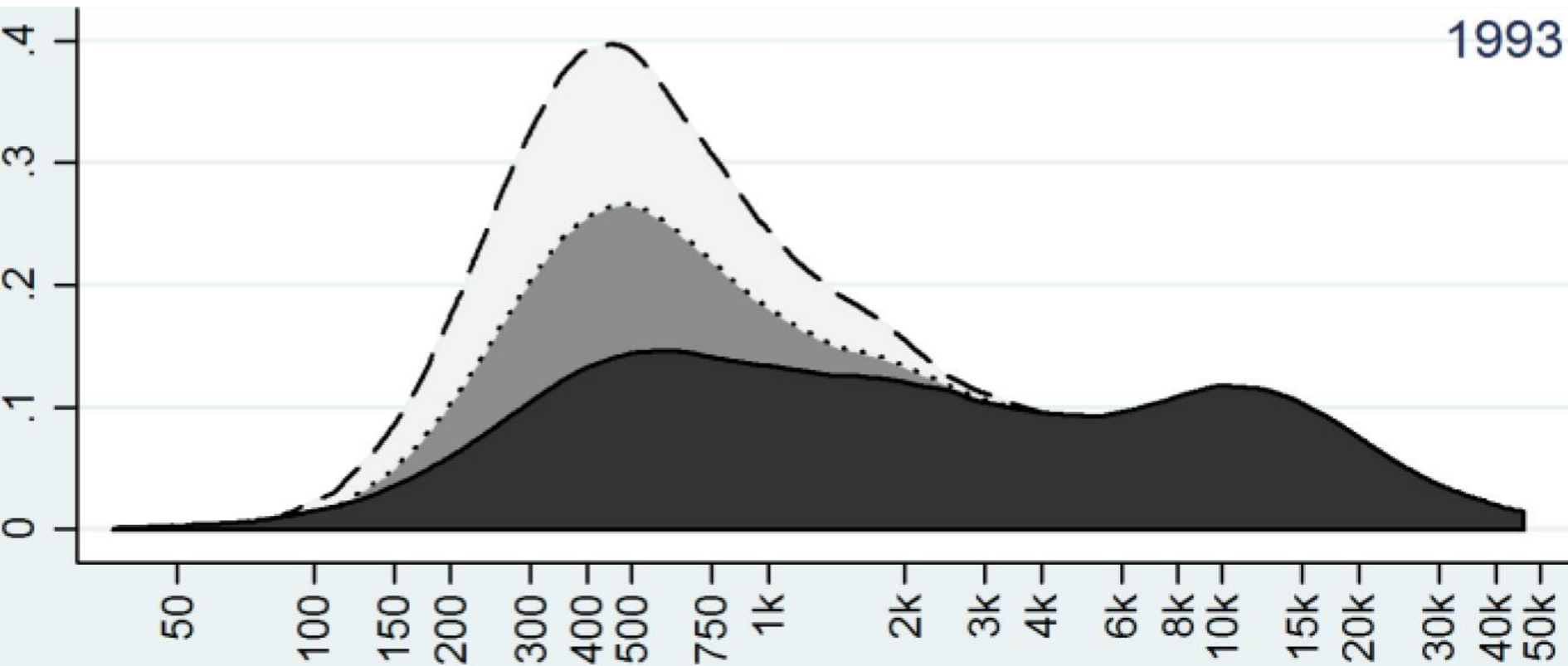
Figure 2: The global distribution of income over time
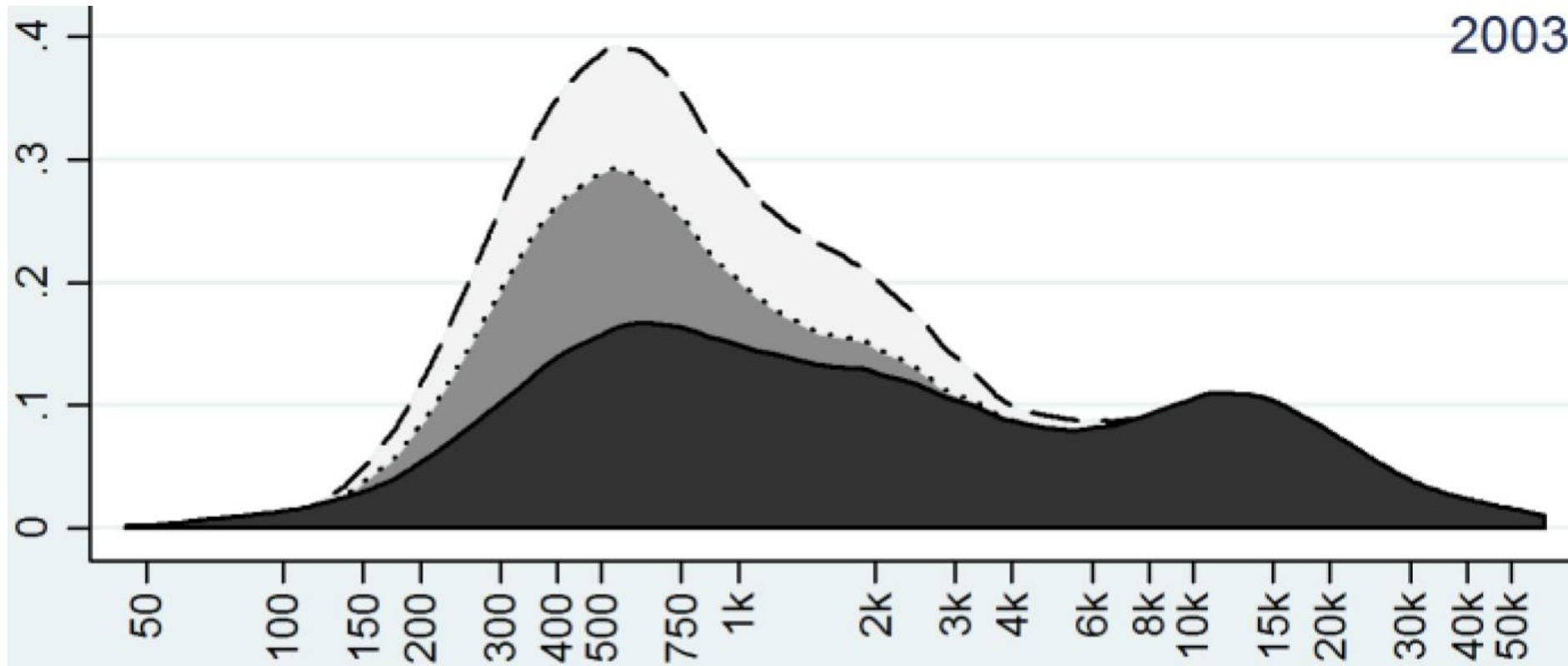logarithmic scale, population-weighted
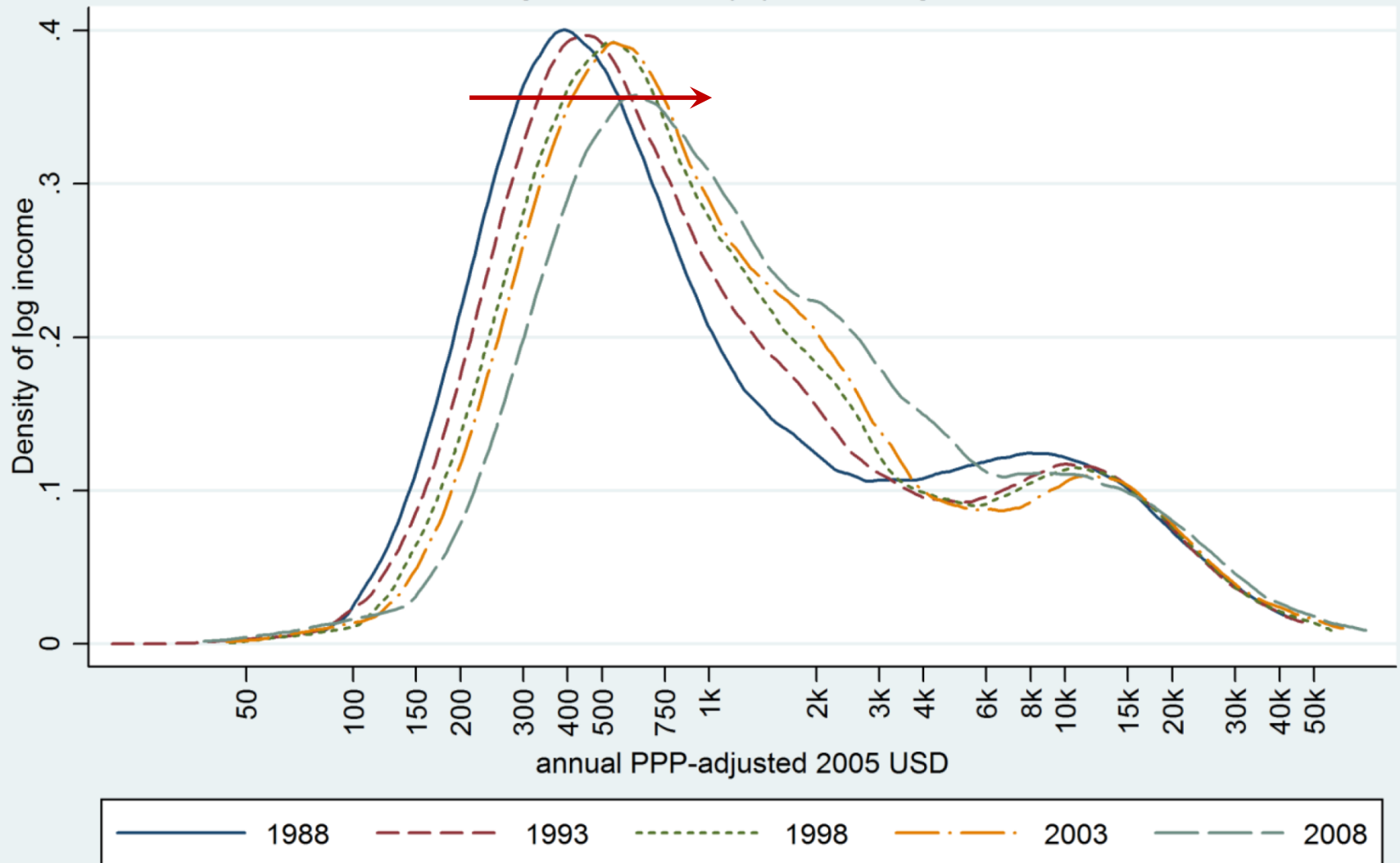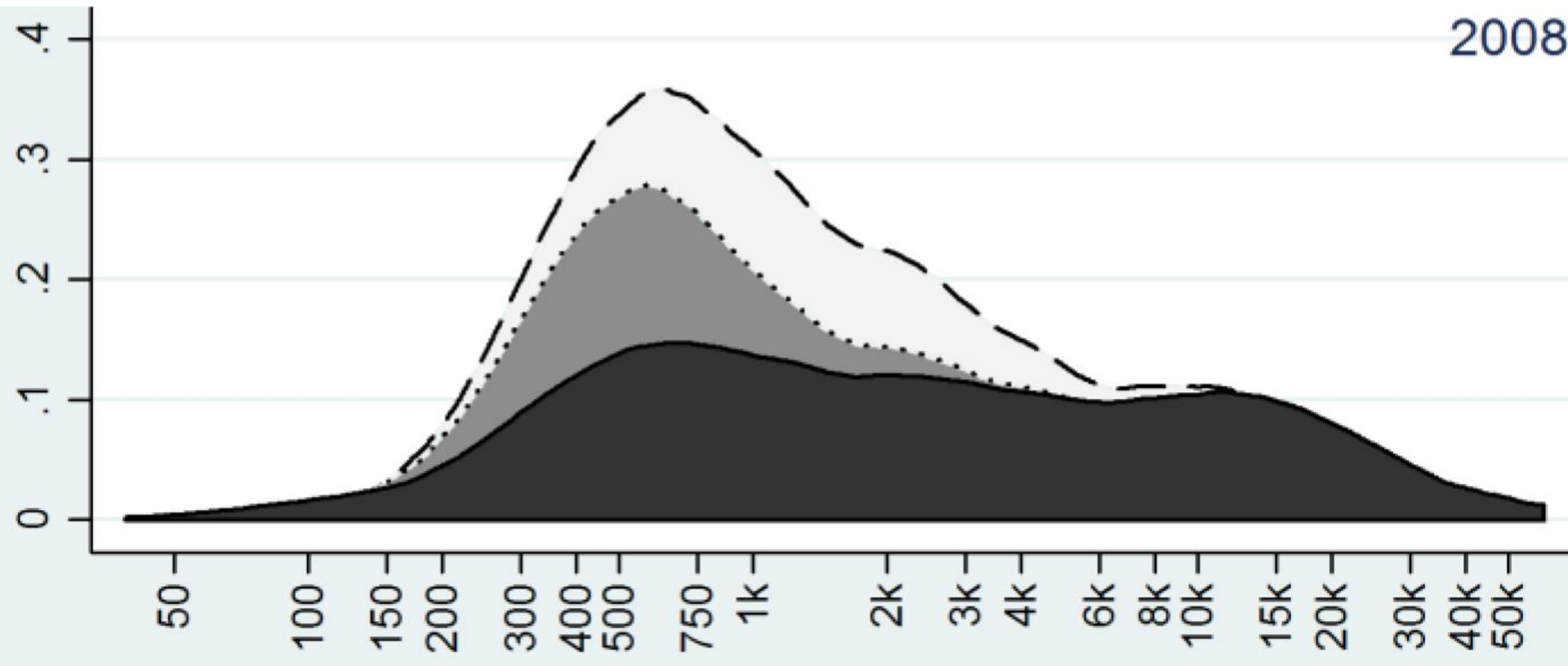
World data
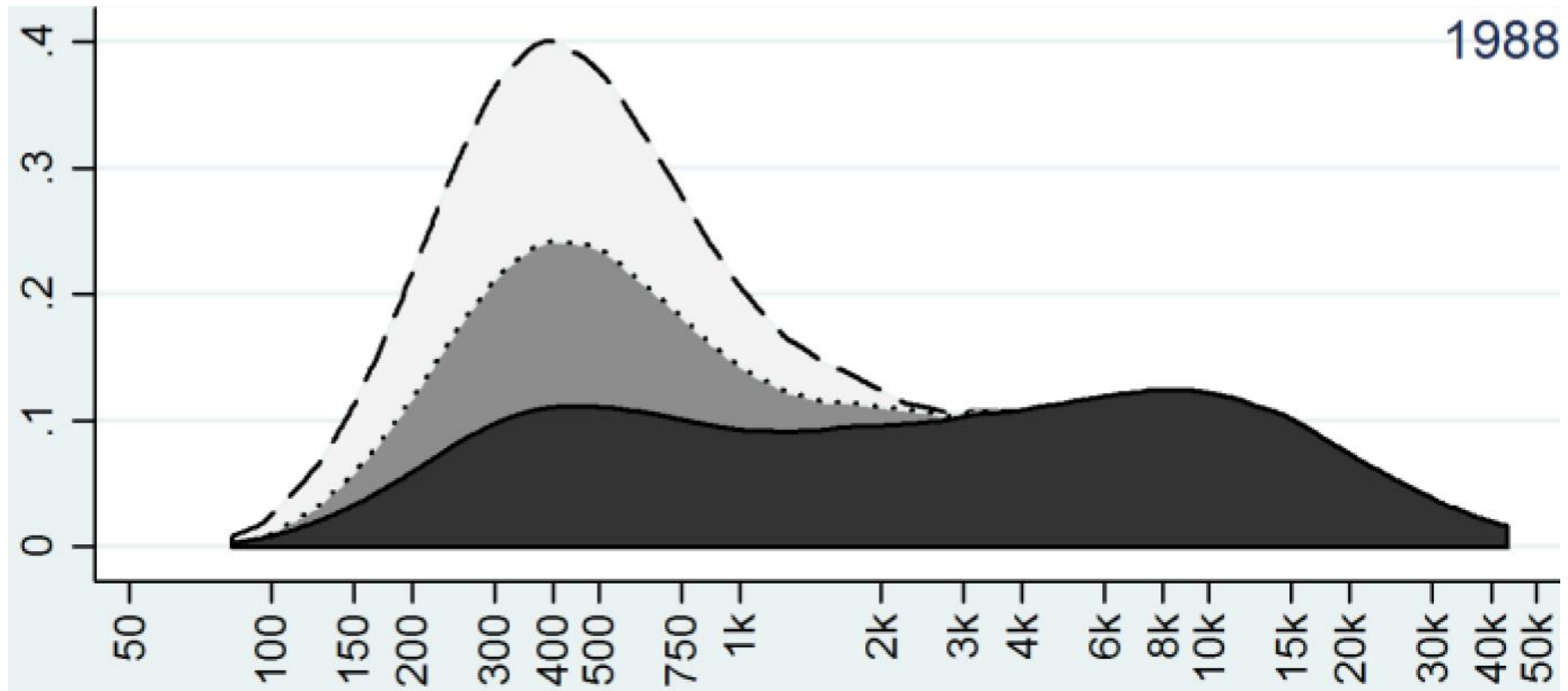
World data
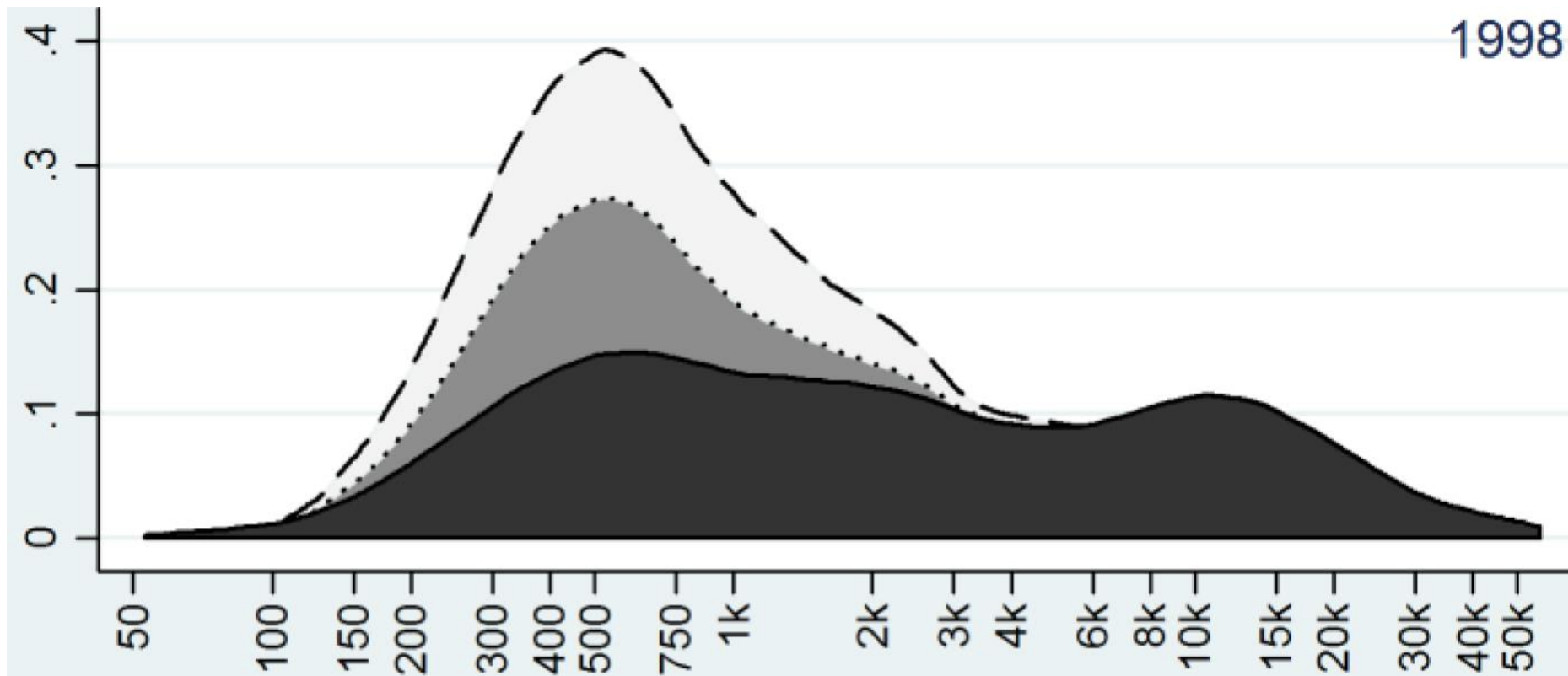
World data

World data

World data

4- Trade and wage inequality

World Data

Income distribution across the world

→ Increase in income for the top incomes
→ Increase in income for bottom incomes?

- Large changes driven by China
- Decrease in bottom incomes w/o China

4- Trade and wage inequality

Summary

Can the Heckscher-Ohlin model explain wage inequality?

- Can explain increases in skill premium in skill-abundant countries

- Can explain global reduction in inequality

- But HO can't explain increases in skill premium in countries abundant in unskilled labor