1- Offshoring

- Definitions and examples
- How does offshoring alter the activities of the firm performed in a country?
- Impact of offshoring on labor markets in general equilibrium:
  - Demand for labor by skill category
  - Relative wage of workers at home and abroad.
- Gains from offshoring

1- Offshoring

"The provision of a service or the production of various parts of a good in different countries that are then used or assembled into a final good in another location is called **foreign sourcing** or, more simply, **offshoring**."

- Offshoring is trade in *intermediate inputs*
  (may include goods and services)

- Similarity to immigration: firms are able to employ foreign workers, even though those workers do not have to leave their home countries.

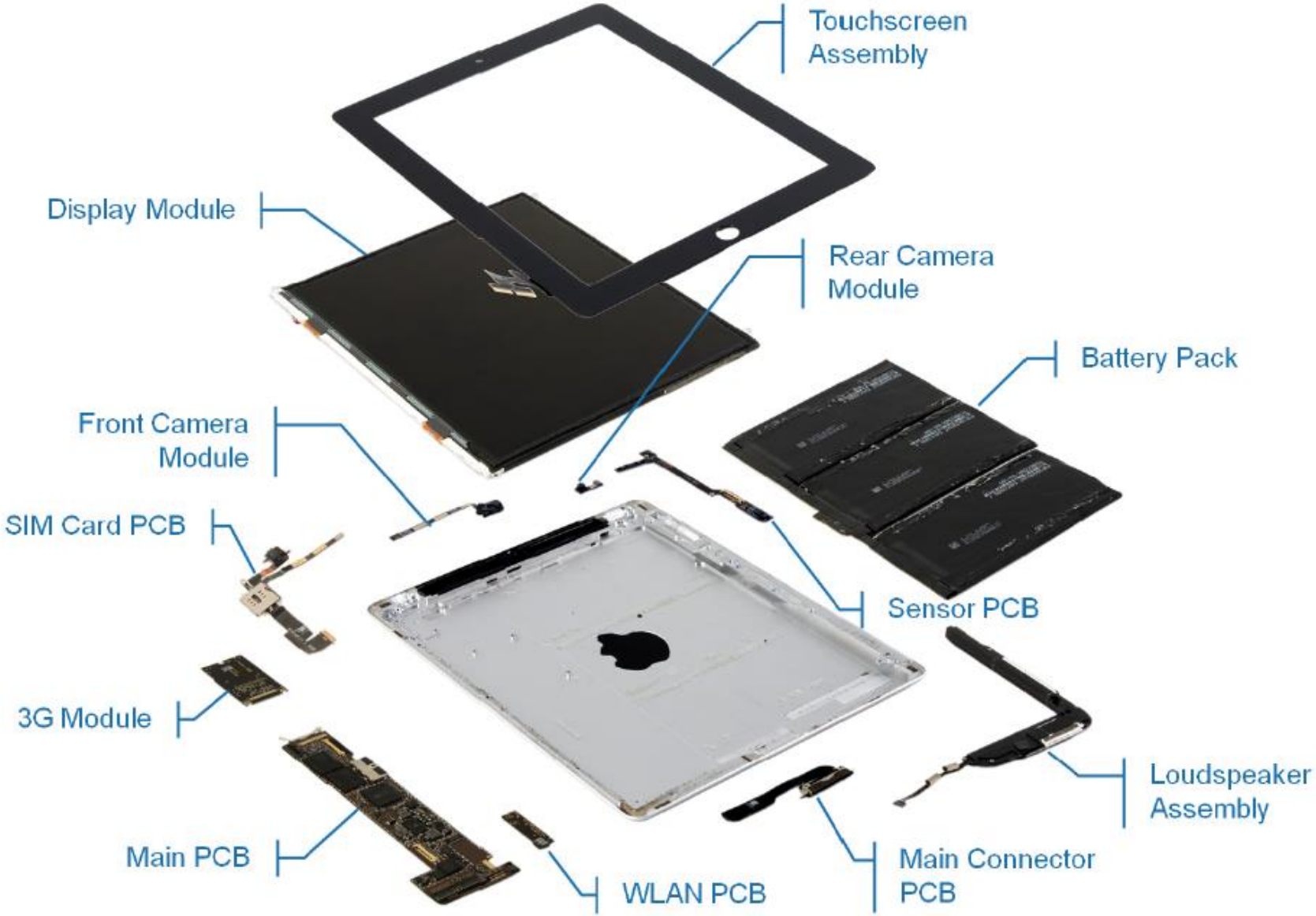
1- Offshoring

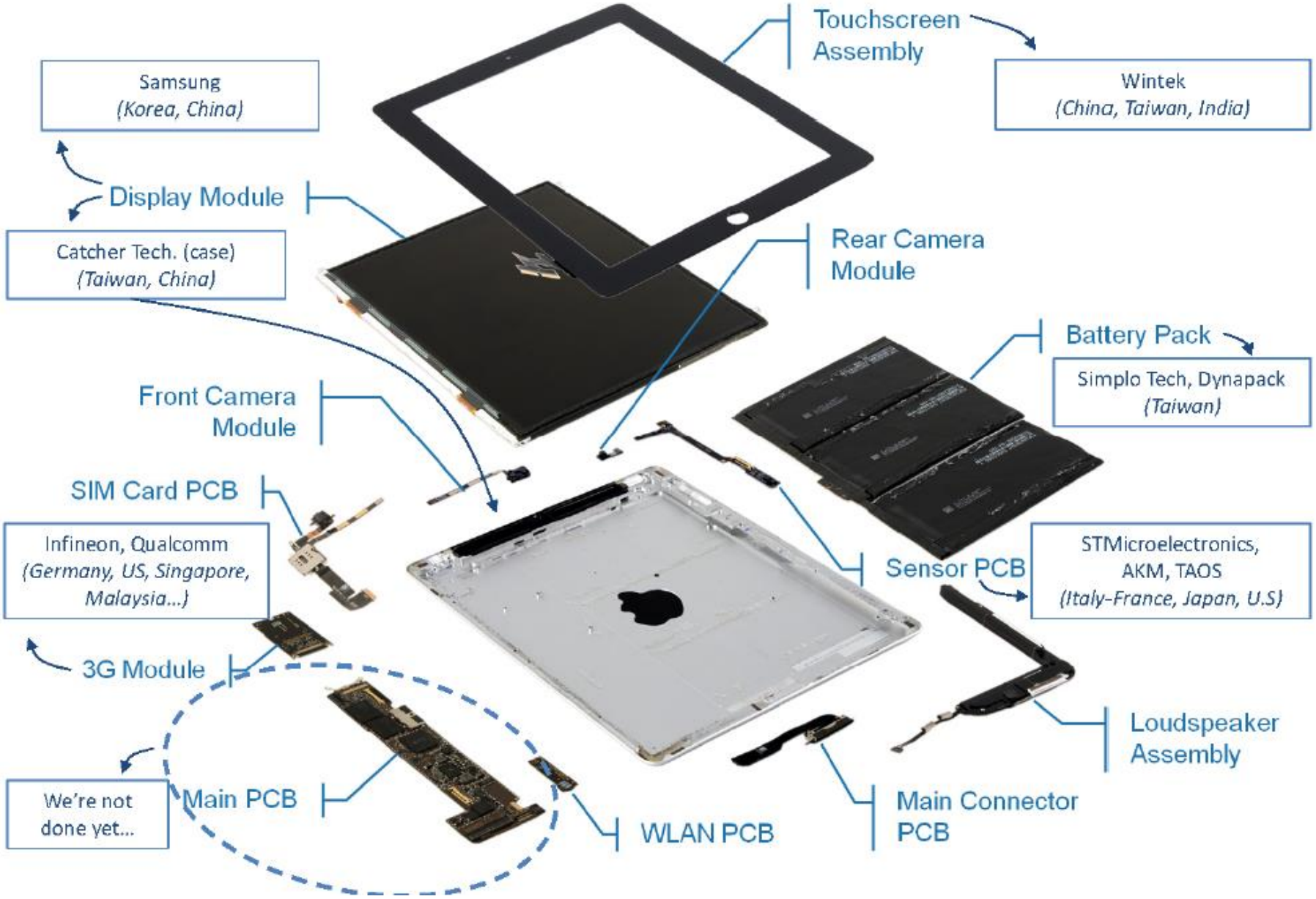
Offshoring and fragmentation of production:
Some famous examples:

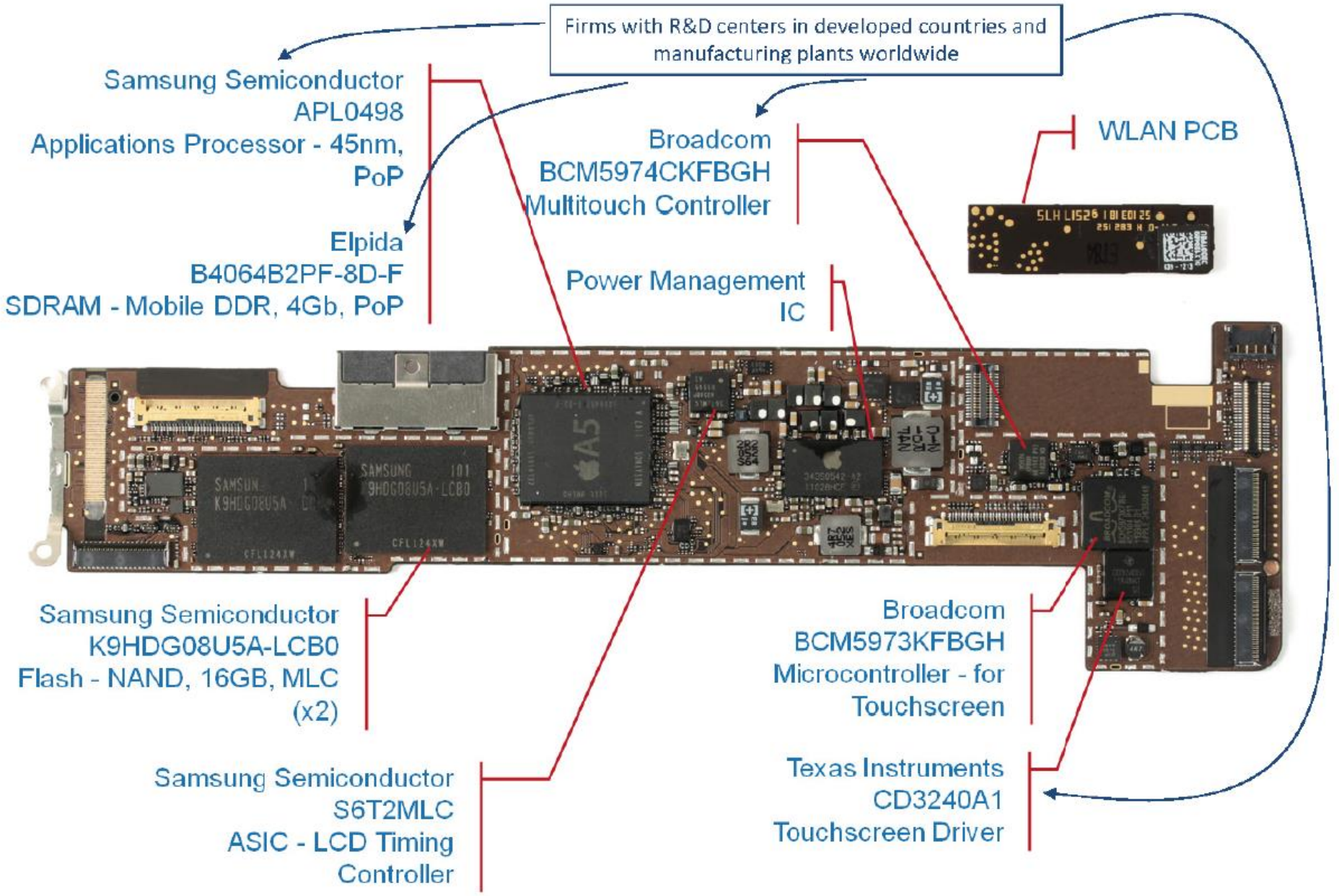
- iphone & ipods & ipads
- Airbus/Boeing
- Barbie doll
- T-shirts, etc.

iPad

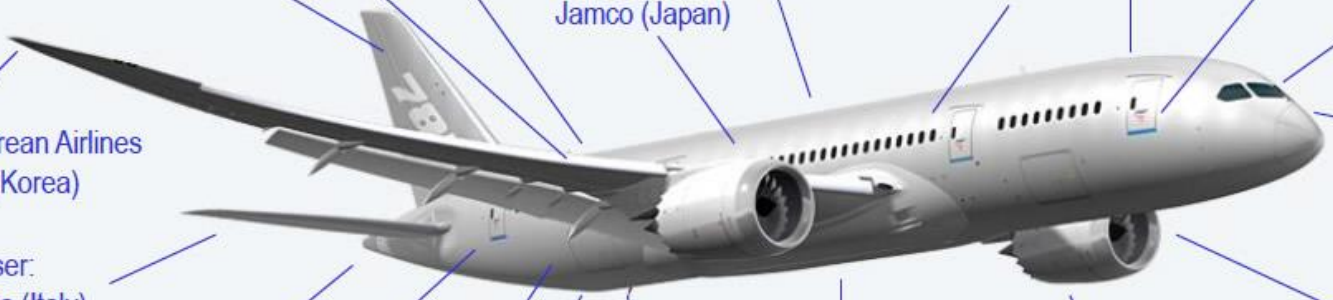
Designed by Apple in California,
Assembled in China (now also Brazil) by Taiwan-based Foxxconn and Pegatron


Touchscreen Assembly
Display Module
Rear Camera Module
Battery Pack
Front Camera Module
SIM Card PCB
Sensor PCB
3G Module
Loudspeaker Assembly
Main PCB
WLAN PCB
Main Connector PCB


Touchscreen Assembly
Wintek (China, Taiwan, India)
Samsung (Korea, China)
Display Module
Catcher Tech. (case) (Taiwan, China)
Rear Camera Module
Battery Pack
Simplo Tech, Dynapack (Taiwan)
Front Camera Module
SIM Card PCB
Infineon, Qualcomm (Germany, US, Singapore, Malaysia...)
Sensor PCB
STMicroelectronics, AKM, TAOS (Italy-France, Japan, U.S)
3G Module
Loudspeaker Assembly
We're not done yet...
Main PCB
WLAN PCB
Main Connector PCB


Firms with R&D centers in developed countries and manufacturing plants worldwide
Samsung Semiconductor
APL0498
Applications Processor - 45nm, PoP
Elpida
B4064B2PF-8D-F
SDRAM - Mobile DDR, 4Gb, PoP
Broadcom
BCM5974CKFBGH
Multitouch Controller
Power Management IC
WLAN PCB
Samsung Semiconductor
K9HDG08U5A-LCB0
Flash - NAND, 16GB, MLC (x2)
Samsung Semiconductor
S6T2MLC
ASIC - LCD Timing Controller
Broadcom
BCM5973KFBGH
Microcontroller - for Touchscreen
Texas Instruments
CD3240A1
Touchscreen Driver

Fragmentation of production: the example of the Boeing 787 Dreamliner



Wing box: Mitsubishi Heavy Industries (Japan)
Wing ice protection: GKN Aerospace (UK)

Centre fuselage: Alenia Aeronautica (Italy)

Forward fuselage:
Kawasaki Heavy Industries (Japan)
Spirit Aerosystems (USA)

Escape slides: Air Cruisers (USA)

Rear fuselage:
Boeing South Carolina (USA)

Vertical Stabiliser: Boeing
Commercial Airplanes (USA)

Doors & windows:
Zodiac Aerospace (USA)
PPG Aerospace (USA)

Lavatories:
Jamco (Japan)

Flight deck seats:
Ipeco (UK)

Raked wing tips: Korean Airlines
Aerospace division (Korea)

Flight deck controls:
Esterline (USA),
Moog (USA)

Horizontal Stabiliser:
Alenia Aeronautica (Italy)

Engines: GE Engines (USA),
Rolls Royce (UK)

Aux. power unit: Hamilton
Sundstrand (USA)

Centre wing box:
Fuji Heavy Industries (Japan)

Engine nacelles: Goodrich (USA)

Passenger doors:
Latécoère Aéroservices (France)

Tools/Software: Dassault Systemes (France)
Navigation: Honeywell (USA)
Pilot control system: Rockwell Colins (USA)
Wiring: Safran (France)

Cargo doors: Saab (Sweden)

Landing gear: Messier-Dowti (France)
Electric brakes: Messier-Bugatti (France)
Tires: Bridgestone Tires (Japan)

Prepreg composites:
Toray (Japan)

Final assembly: Boeing
Commercial Airplanes (USA)

Source: www.newairplane.com

1- Offshoring

The “American” car:

Who adds value? (source: WTO 2008)

= 30%: assembly from Korea

+ 17.5%: components and adv. technology from Japan

+ 7.5%: design from Germany

+ 4%: minor parts from Taiwan and Singapore

+ 2.5%: advertising and marketing services from UK

+ 1.5%: data processing from Ireland and Barbados

+ 37% of remaining value is from U.S.

1- Offshoring

Tracking value added

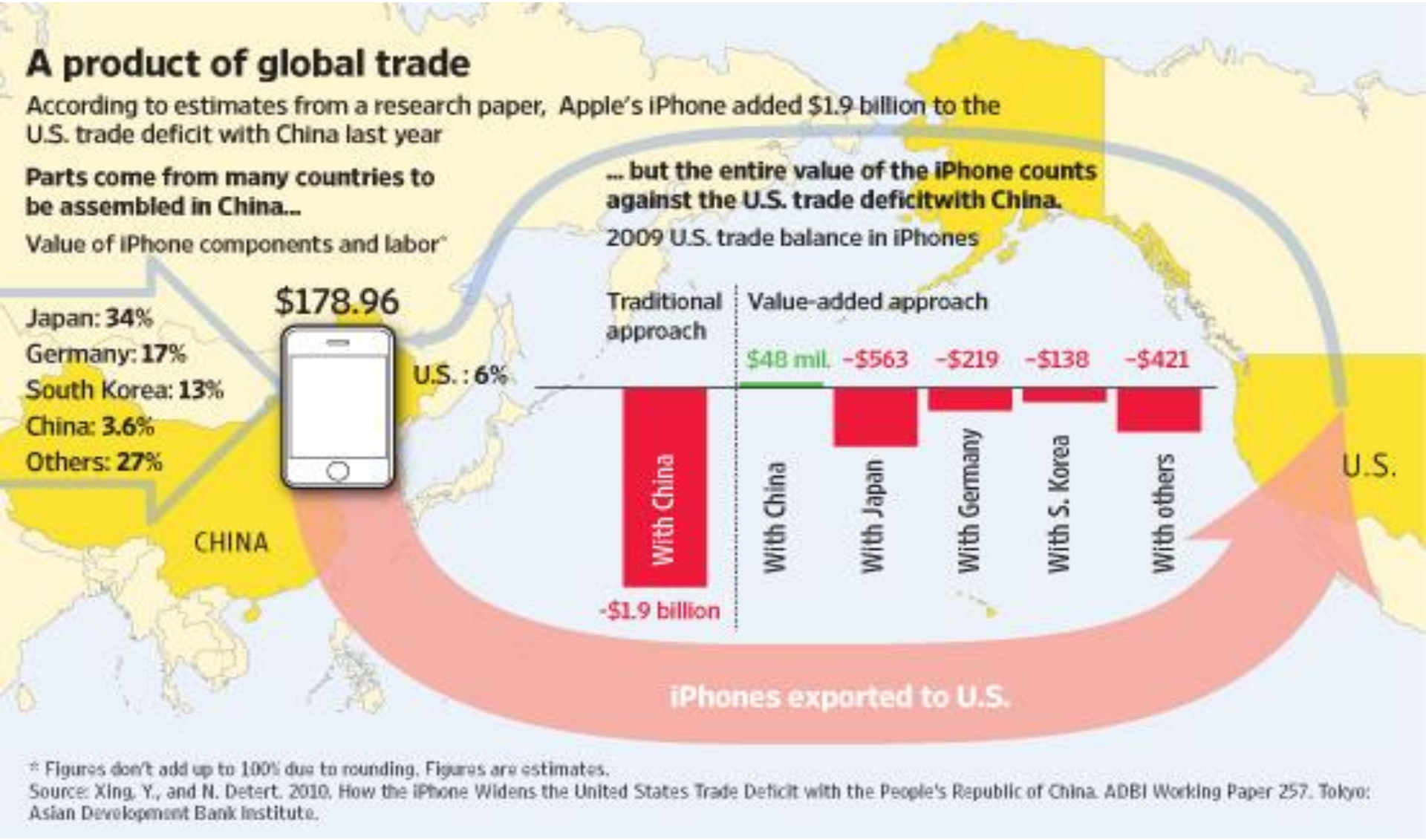
… has become a challenge:

- Do imports from China measure how value is added by China to consumers goods in the US?

- Example: iphone

- contributes to the US trade deficit with China?
- The value of imports of iphone does not reflect the value added in China, and may actually reflect some of the value aded by Japan, Korea, Malaysia… and the US.

iPhone: Made in China?



WSJ 12.15.10

1- Offshoring

“Offshoring”

Other names:

- Fragmenting production
- Slicing up the value chain
- Disintegration of production
- Delocalization
- Global production sharing
- Unbundling
- Flattening of the world, etc.

1- Offshoring

A Second Globalization Revolution:

- You can consume goods from different parts of the world
  = First “unbundling”

- AND goods can be produced in different parts of the world
  = Second “unbundling”

→ Question: Same implications for wages and welfare?

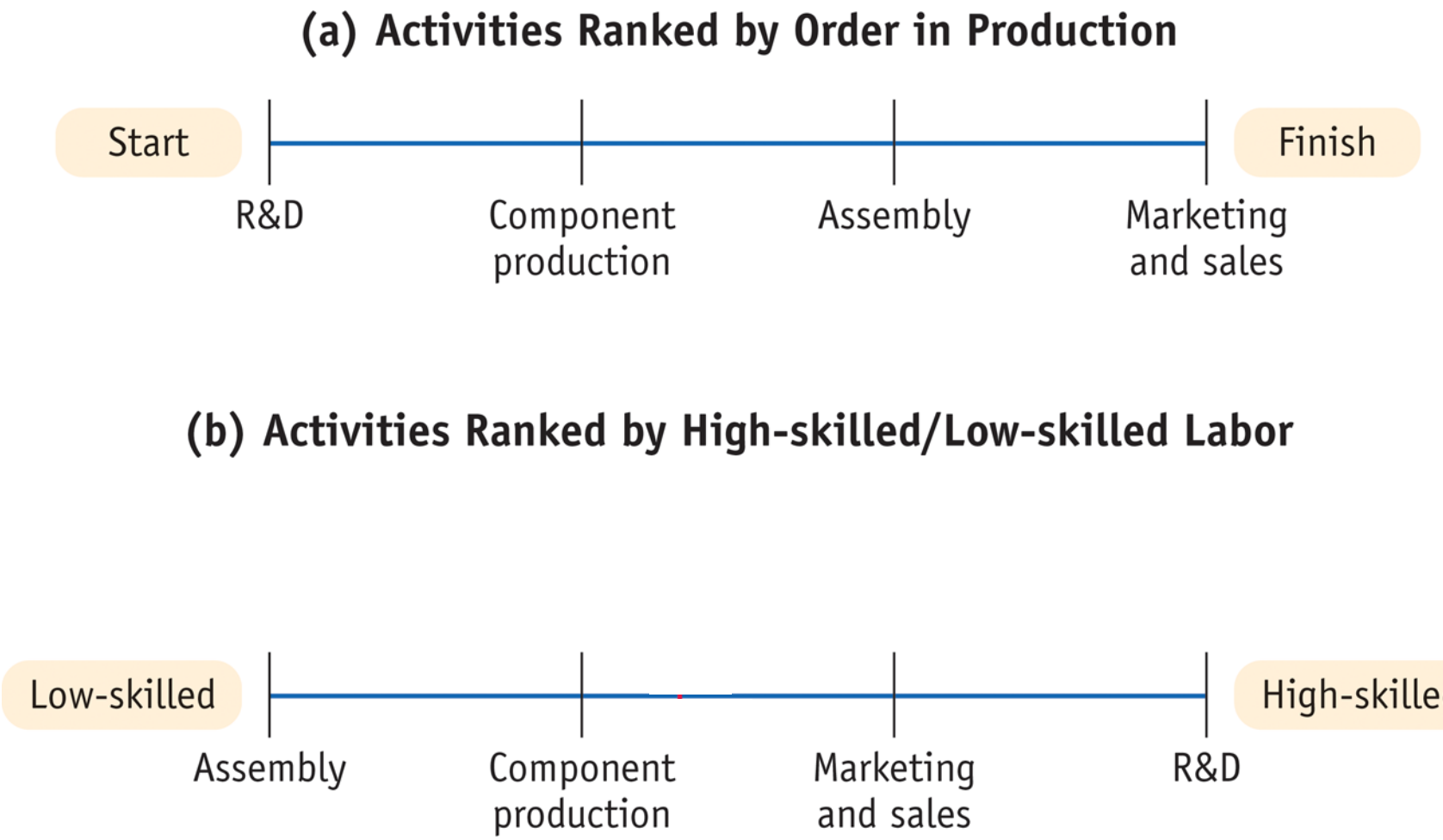
2- A simple model of Offshoring

Now let's start thinking about how to model offshoring

Key question: Which activities are being offshored?

a) Depends on the timing of the production process?

b) Or depends primarily on the worker qualification (skills) required for each task?


(a) Activities Ranked by Order in Production
Start
Finish
R&D
Component production
Assembly
Marketing and sales
(b) Activities Ranked by High-skilled/Low-skilled Labor
Low-skilled
High-skilled
Assembly
Component production
Marketing and sales
R&D

2- A simple model of Offshoring

Relative Wage of Skilled Workers

Gains from offshoring: lower wages.

Our first assumption is that Foreign unskilled-labor wages are less than those at Home, so

- $W^*_L < W_L$

Also, we assume that the relative wage of low-skilled labor is lower in Foreign than at Home, so

- $W^*_L/W^*_H < W_L/W_H$.

2- A simple model of Offshoring

Costs of offshoring

The firm must also take into account extra costs of doing business there:

- Higher prices to build a factory
- Extra costs of communication or transportation.

We assume that these extra costs apply uniformly across all the activities in the value chain.

Communication costs & trade costs summarized by "T >1"

- *Cost of high-skilled labor at home:* W_H
- *Cost of low-skilled labor at home:* W_L
- *Cost of offshoring high-skilled tasks:* $T \cdot W^*_H$
- *Cost of offshoring low-skilled tasks:* $T \cdot W^*_L$

2- A simple model of Offshoring

Which case is **not** possible?

c) $T.W^*_L > W_L$ *and* $T.W^*_H < W_H$

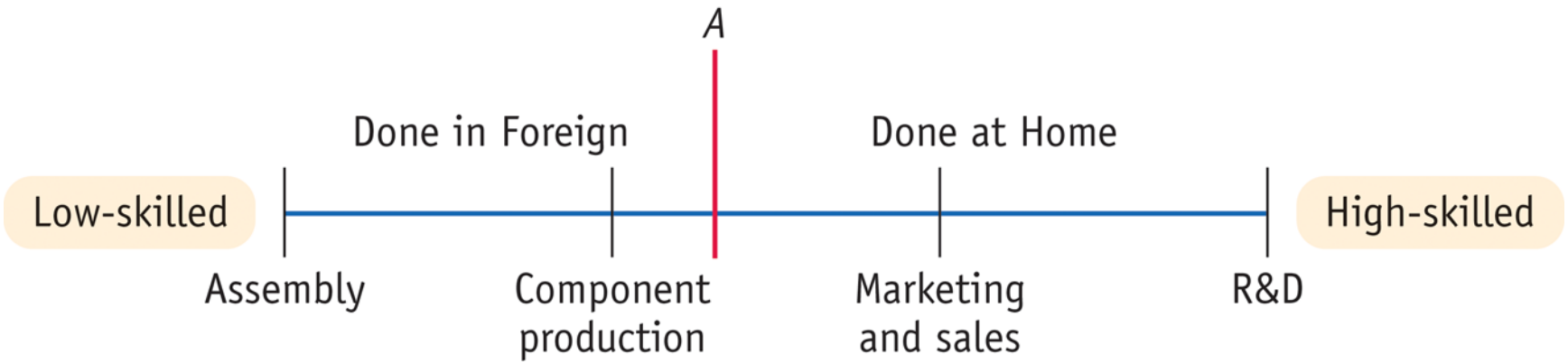
otherwise we would have $W_L / W^*_L < T < W_H / W^*_H$
which contradicts our assumption $W^*_L/W^*_H < W_L/W_H$

→ More likely case is:

b) $T.W^*_L < W_L$ *and* $T.W^*_H > W_H$

Which implies that low-skilled tasks are offshored while most skilled tasks are performed at home.

(b) Activities Ranked by High-skilled/Low-skilled Labor



2- A simple model of Offshoring

Example of production function

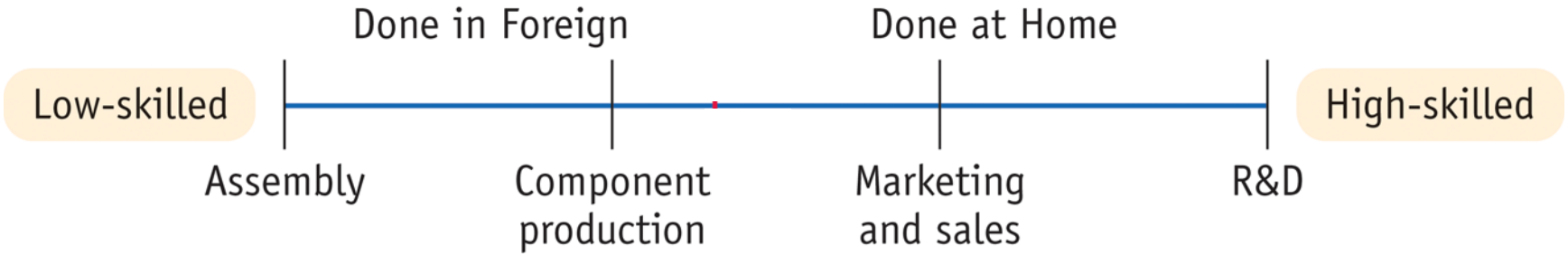
- Production one unit of final good requires many tasks "s" ordered along an axis from s=0 to s=1.
- Each task "s" requires "s" skilled workers and "1-s" unskilled workers

→ Cost of a task "s": $C(s) = sW_H + (1-s)W_L$

→ Price of final good if there is no offshoring:

$$P_F = \int_{s=0}^{s=1} C(s)ds = \int_{s=0}^{s=1} [sW_H + (1-s)W_L]ds$$

(b) Activities Ranked by High-skilled/Low-skilled Labor



s=0 → increasing s → s=1

2- A simple model of Offshoring

Which tasks "s" are offshored?

- With offshoring: $TC^*(s) = TsW_H^* + T(1-s)W_L^*$

- If you offshore task "s", you can replace C(s) by T.C*(s) in the calculation of the final good price

- Decision to offshore depends on "s": skill intensity

- Firms try to minimize the final cost:

Hence offshore all tasks where: *T.C*(s) < C(s)*

2- A simple model of Offshoring

Which tasks "s" are offshored?

- **Case 1**: If $T < W_H / W_H^* < W_L / W_L^*$

Then *T.C*(s) < C(s) for all "s"*: **All tasks are offshored!**

- **Case 2:** If $W_H / W_H^* < W_L / W_L^* < T$

Then *T.C*(s) > C(s) for all "s"*: **No task is offshored!**

- **Case 3:**

"Interesting" case is when $W_H / W_H^* < T < W_L / W_L^*$

2- A simple model of Offshoring

Which tasks “s” are offshored?

- **Case 3:** If $W_H / W_H^* < T < W_L / W_L^*$

Which tasks “s” are being offshored?

All tasks for which T.C*(s) < C(s)

2- A simple model of Offshoring

Which tasks "s" are offshored?

- **Case 3:** If $W_H/W_H^* < T < W_L/W_L^*$

Offshore task "s" if it is below a threshold s*:

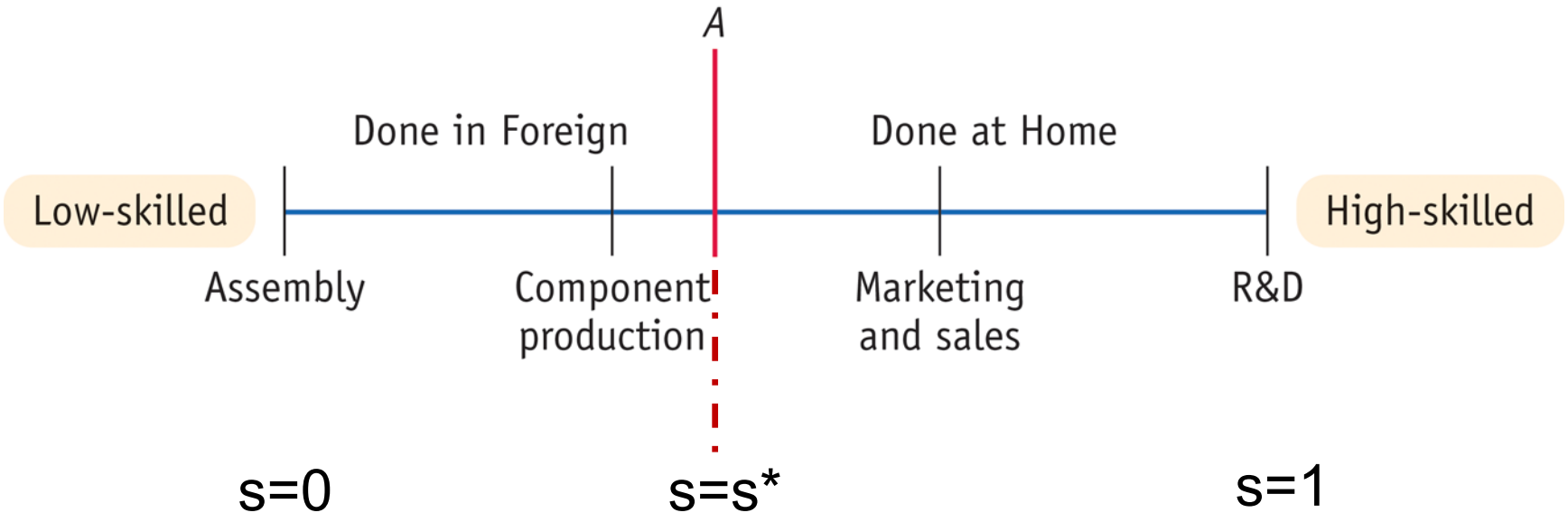
$$TsW_H^* + T(1-s)W_L^* < sW_H + (1-s)W_L$$

$$\Leftrightarrow s < \frac{W_L - TW_L^*}{(TW_H^* - W_H) + (W_L - TW_L^*)} \equiv s^* \in (0,1)$$

→ Low-skill tasks s<s* are offshored to Foreign,

→ High-skill tasks s>s* are performed in Home

(b) Activities Ranked by High-skilled/Low-skilled Labor



2- A simple model of Offshoring

Changing the Costs of Trade (decrease in T)

Offshoring on the Value Chain

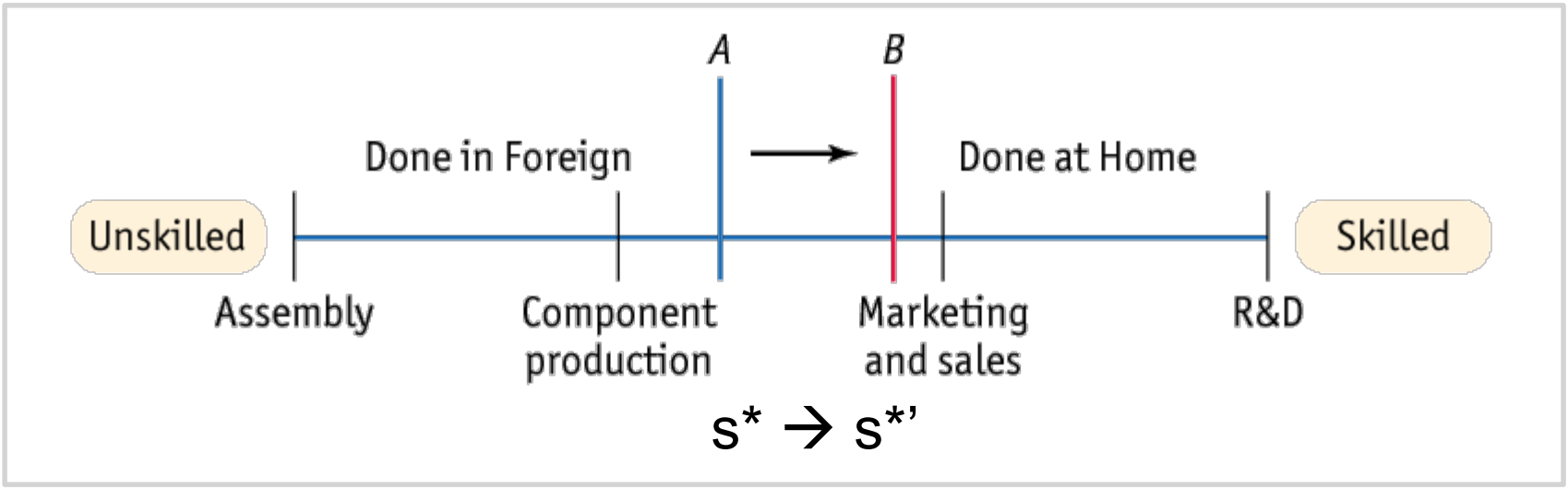
- Reduction in T leads to more offshoring, i.e. higher s*
- A larger range of activities are now done in Foreign

Questions:

- Impact on relative demand for skilled workers?
- Impact on wage inequality in each country?

2- A simple model of Offshoring

Changing the Costs of Trade (decrease in T)

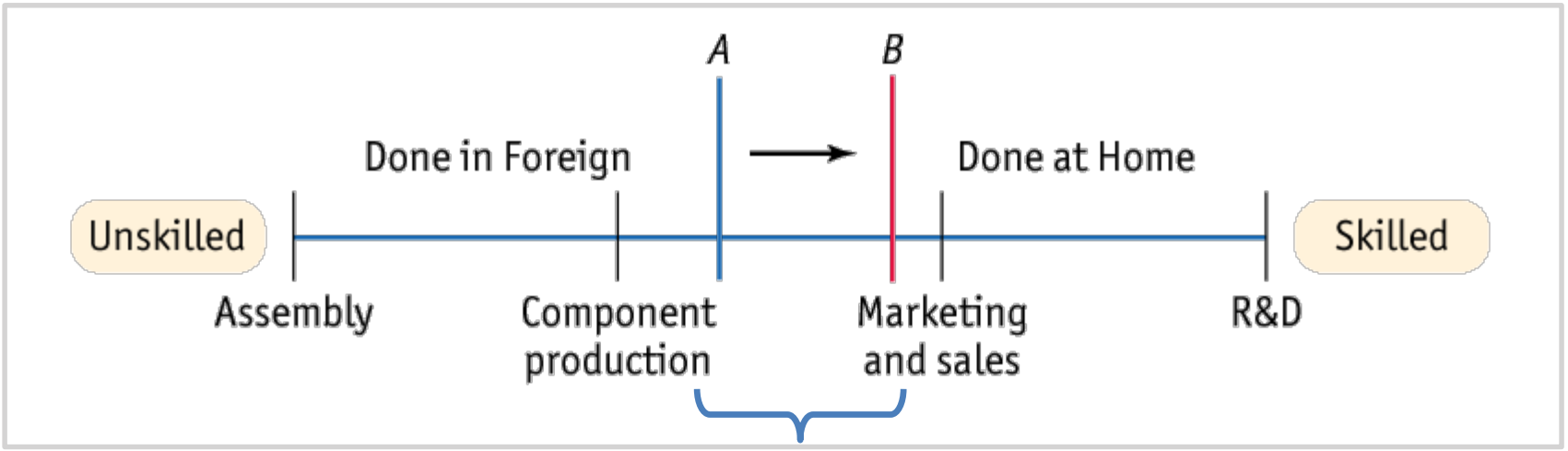


Offshoring on the Value Chain

- Reduction in T → more offshoring, higher s*
- Activities between *A* and *B* are now done in Foreign.

2- A simple model of Offshoring

Changing the Costs of Trade (decrease in T)

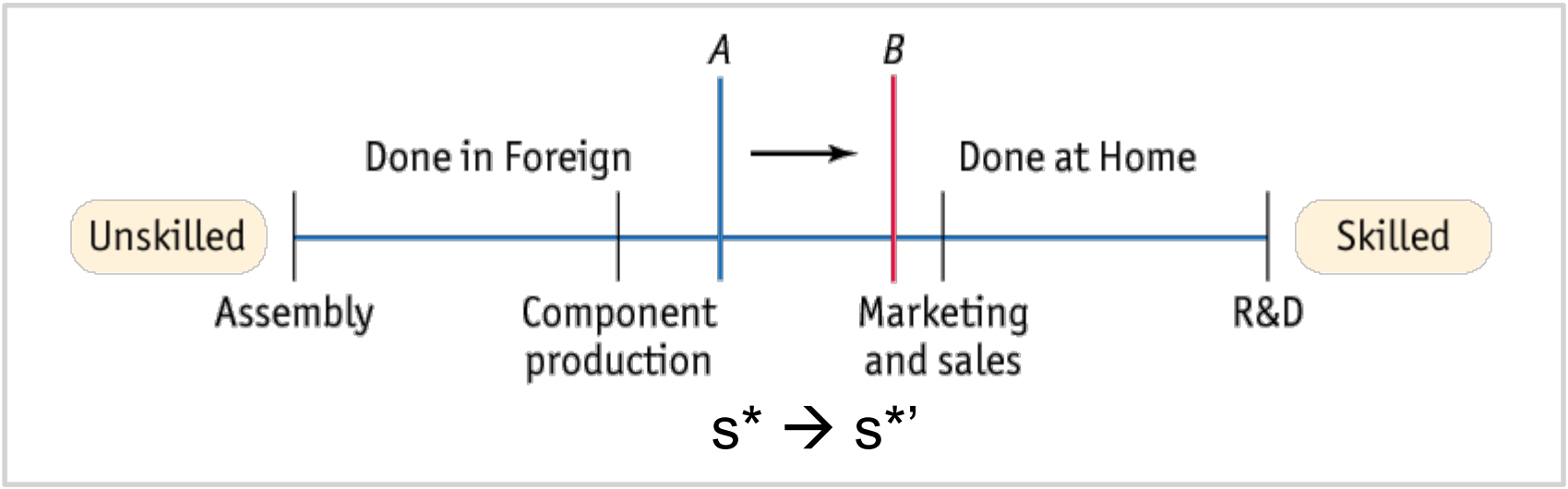


These activities (*between A and B*) are:

- more skill-intensive than the activities formerly done in Foreign (*to the left of A*)
- but less skill-intensive than the activities now done at Home (*to the right of B*).

2- A simple model of Offshoring

Changing the Costs of Trade (decrease in T)

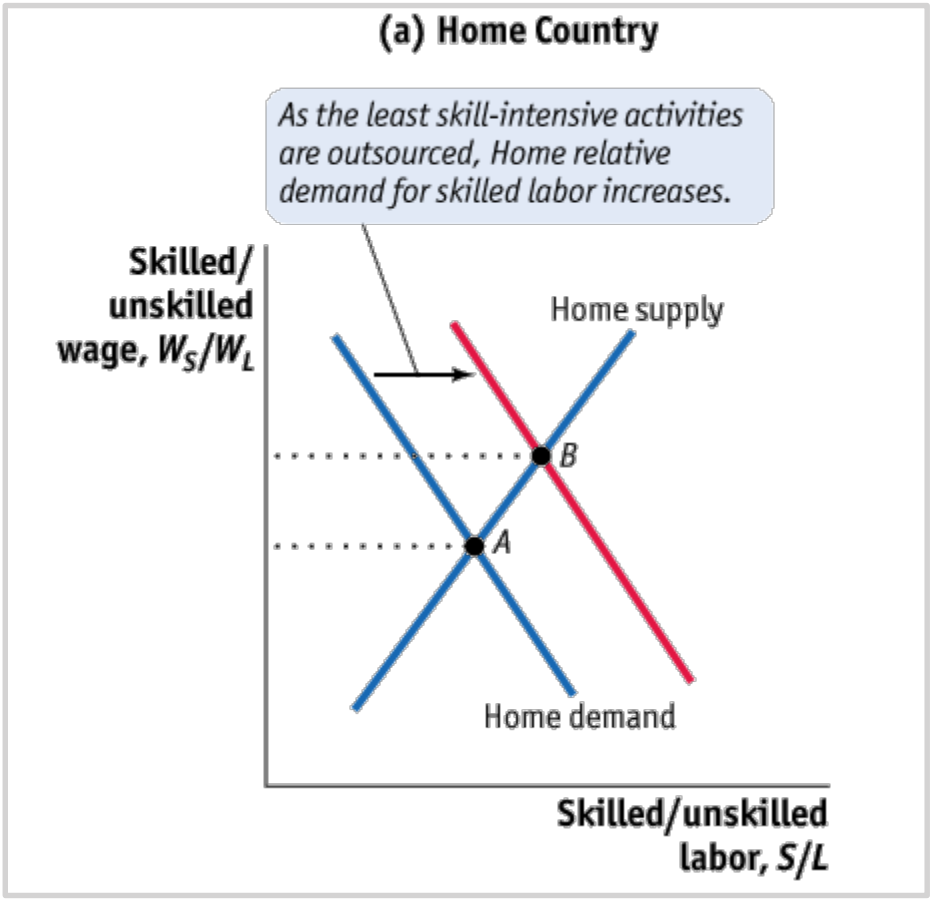


Offshoring on the Value Chain

- Reduction in T → more offshoring, higher s*
- Activities between *A* and *B* are now done in Foreign.

2- A simple model of Offshoring

Change in Foreign Labor Demand and Relative Wage

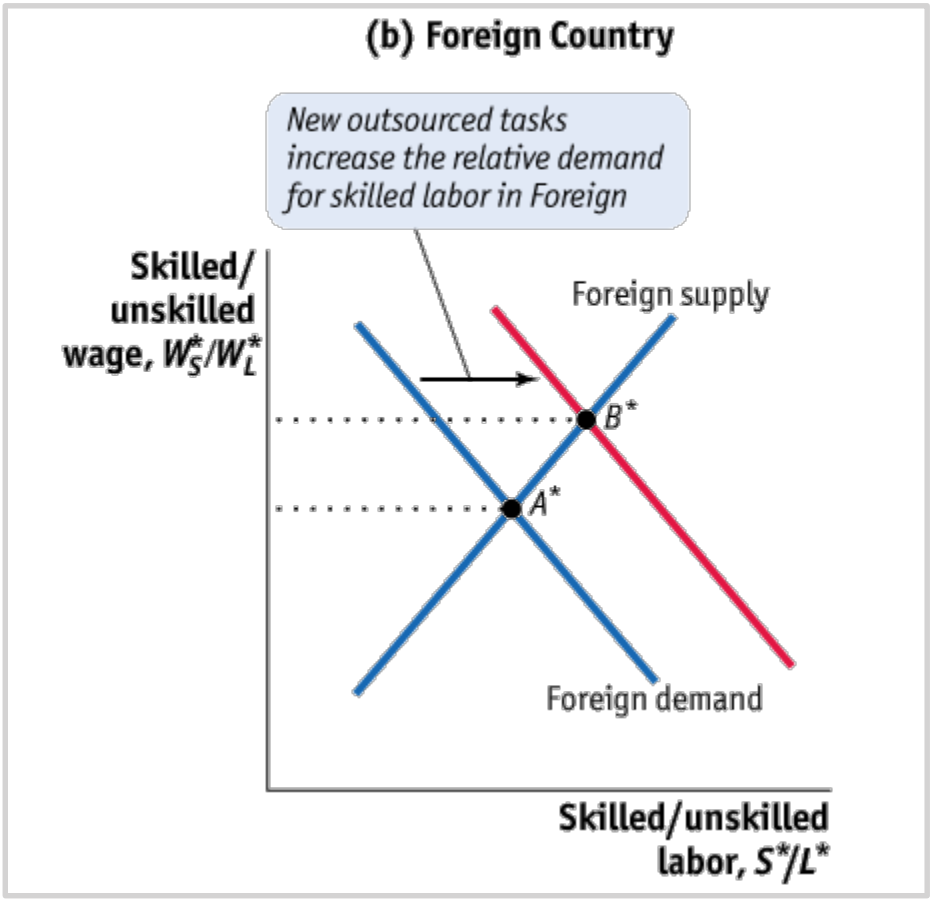


Change in the Relative Demand for High-skilled/Low-skilled Labor (HOME)

- Offshoring of the least skill-intensive activities:
- Hence the relative demand for skilled labor at Home increases,
- and the relative wage rises.

2- A simple model of Offshoring

Change in Foreign Labor Demand and Relative Wage



Change in the Relative Demand for High-skilled/Low-skilled Labor (FOREIGN)

- Activities shifted to Foreign are more skill intensive than those formerly done there.
- Hence the relative demand for skilled labor in Foreign also increases
- It follows that the relative wage for skilled labor in Foreign also rises, from point A^* to point B^*.

2- A simple model of Offshoring

Skill premium increase

In sum, the skill premium increases in both countries:

- *In Home because offshored jobs are relatively less skilled-labor intensive*
- *In Foreign because offshored jobs are relatively more skilled-labor intensive*

2- A simple model of Offshoring

Skill premium increase

In sum, the skill premium increases in both countries:

➔ Not the same prediction as with Heckscher-Ohlin model

According to the H-O model, the relative demand for skilled labor should decrease in Foreign if Foreign is relatively less abundant in skilled labor.

3- The Gains from Offshoring

Now:

- Does everyone gain from offshoring?

3- The Gains from Offshoring

- We have shown that offshoring can shift the relative demand for labor, and raise the skill premium.

  Hence, offshoring will decrease the wage of unskilled workers ***relative*** to skilled workers

- However, offshoring reduces production costs which, in a competitive market, reduces prices.

➔ *Can offshoring benefit both types of workers?*

3- The Gains from Offshoring

Prices:

Price of final good with offshoring:

$$P_F = \int_{s=0}^{s=s^*} TC^*(s)ds + \int_{s=s^*}^{1} C(s)ds < \int_{s=0}^{1} C(s)ds$$

is lower than the price without offshoring

Wage/Price:

- If the labor supply is “inelastic” (vertical), unskilled-labor wages will fall more than prices
- If the labor supply is “elastic” (flat), unskilled-labor wages will fall less than prices

3- The Gains from Offshoring

Gains from Offshoring for unskilled workers?

- While skilled workers unambiguously gain, it's more ambiguous for unskilled workers:

  (+) productivity gains

  (-) displacement from offshoring

→ Overall effect is ambiguous in theory

3- The Gains from Offshoring

Gains from Offshoring

Conclusions:

- While skilled workers unambiguously gain
- The skill premium increases
- Yet, possible that even unskilled workers also gain from offshoring

4- Evidence on Offshoring

- Offshoring is controversial and is often the topic of intense political debate.
- Most economists tend to be in favor of offshoring
- Evidence on the effect of Offshoring?

+ Discussion on other effects of offshoring,
e.g. transmission of shocks

4- Evidence on Offshoring

Offshoring and multinational activity

- "Offshoring" often associated with multinational activity but not necessarily
- Multinational firms involve suppliers that are affiliated
- One can also have outsourcing offshoring (offshoring with an unaffiliated supplier)

- Note: "Outsourcing" is not a synonym of "Offshoring"!
  "Outsourcing": involve an independent supplier.
  "Offshoring": involves a supplier abroad. One can have outsource within the US, and offshoring without outsourcing.

4- Evidence on Offshoring

Evidence on the US

The fear that offshoring and multinational activity threatens jobs in the United States is overstated:

- Expansion abroad by U.S. multinationals tends to support jobs based in the U.S.
- More investment and employment abroad are strongly associated with more investment and employment in American parent companies.
- Expanding abroad also allows firms to refine their scope of activities.

4- Evidence on Offshoring

Evidence on the US

Amiti and Wei (2014):

- Service offshoring increases labor productivity of US firms by 10%
- Offshoring of manufacturing inputs increases labor productivity of US firms by 5%

4- Evidence on Offshoring

Evidence on **Denmark**: Workers

- Why Denmark? Allow us to track workers more precisely
- Recent study (Hummels et al 2013):
  - **Coverage:**
    - Entire population of firms
    - Entire population of workers
    - Links & tracks workers and firms: 99% match
  - **Info:**
    - Trade, wages, education, occupation, sex, etc.
    - Work status of entire population once a year
    - Detailed data on export and imports by firm

4- Evidence on Offshoring

Characteristics of Trading Firms

Variable	Effect of an increase in offshoring opportunities	Effect of an increase in Exports opportunities
Log(employment)	-0.196	0.346
Log(gross output)	0.151	0.486
Log(capital per worker)	0.099	0.282
Log(annual results)	0.012	0.831
Log(wage bill per worker)	0.127	0.119
Share of high-skilled workers	0.048	0.066
Share of low-skilled workers	-0.048	-0.066

4- Evidence on Offshoring

Summary of study on Denmark

Offshoring induces:

- Decreases in employment
- Increases in output
- Increases in profitability
- Increases in relative employment of skilled workers

Effect on wages:

- Doubling offshoring leads to an 3-8% rise in skilled labor wage,
- 2-5% fall in unskilled labor wage

4- Evidence on Offshoring

Other remarks and discussion topics:

- US as an offshoring destination
- Transmission of shocks

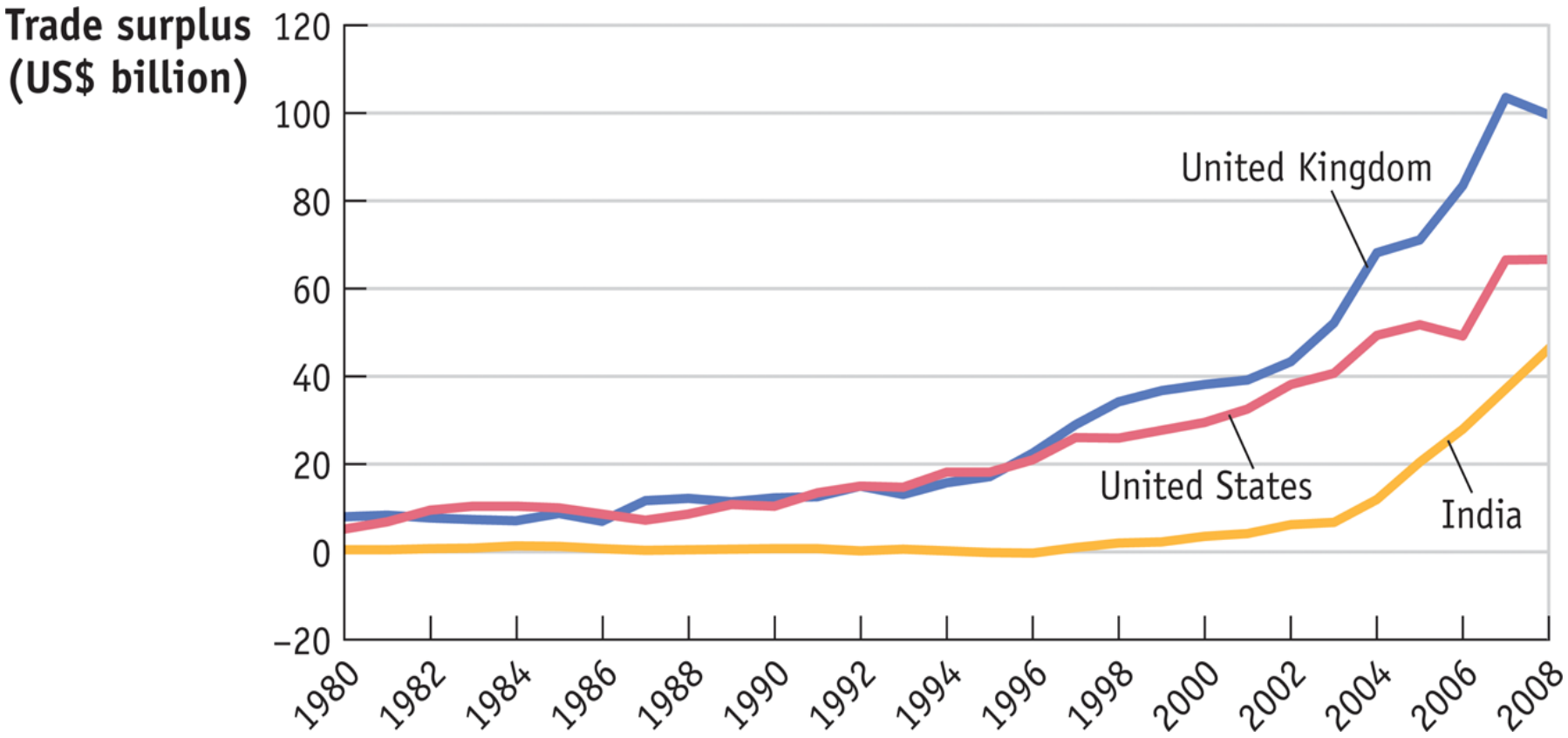
4- Evidence on Offshoring

Conversely: The US is a provider of offshoring activities

- In manufacturing but especially in service industries
- **Traditionally:** offshoring is about trade in components
- **Today:** offshoring of services increasingly important.

4- Evidence on Offshoring

Trade Surplus in Business Services



4- Evidence on Offshoring

Global transmission of shocks through production chains

Examples:

- 2011 Earthquake/Tsunami in Japan
  - Affected car component supplies
  - Ipad2 components
- 2012 Floods in Thailand
  - Hard drive producers
- And other events such as: Supplier bankruptcy, etc.

Conclusion

- Definitions and examples
- Offshored tasks likely to be the least skill-intensive
- Offshoring can explain increase in wage inequality in both source and destination countries
- Benefits skilled workers, ambiguous for unskilled workers
  - Debate on the effect of offshoring but generally not as bad as people think
- Other implications: volatility of supply, processing zones, etc.