Trade and the Labor Market

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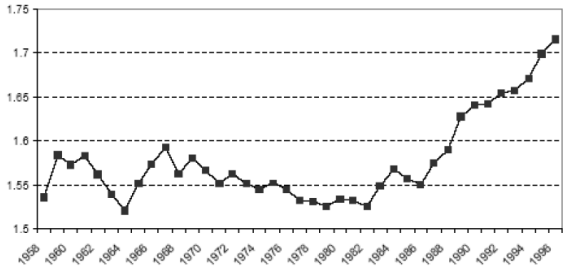
Wage inequality

- Increase of wage gap in the USA, between 1979 and 1995:
  - Real wage of workers with less than 12 years of education fell by 20.2%
  - Real wage of workers with more than 16 years of education rose by 3.4%



Relative wage of non-production / production workers,
U.S. manufacturing

Source: NBER data, Feenstra, 2005

Introduction

- Sorting out the impact of trade on wage and employment inequality is crucial for the economic debate
- Because trade is an obvious natural usual suspect to explain the rise of wage inequality

Outline

I - Stylized facts

II - Offshoring: theory

III - Offshoring: evidence

Stylized facts

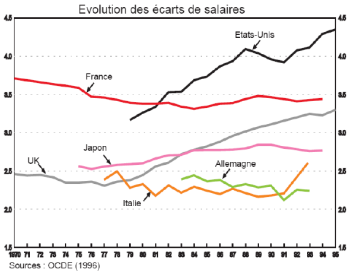
Conventional wisdom: HO model

- Globalization should increase wage inequality in the developed countries, reduce it in developing countries
- In the 90s, important academic debate on the role of trade on income inequality, primarily based on US evidence emphasizing rise in income inequalities together with larger openness to trade

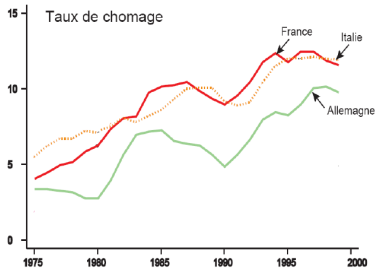
Can trade explain the observed facts?

Stylized facts

- Wage gap also increased in the UK

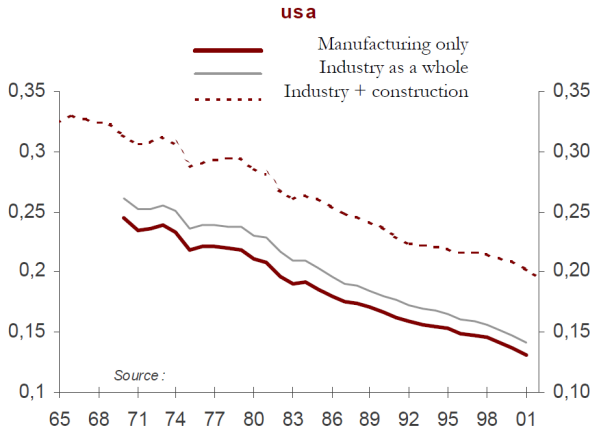


- Unemployment increased in continental Europe



Stylized facts

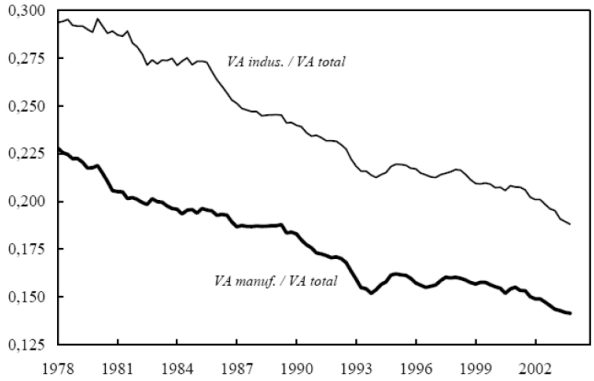
- Deindustrialization in the USA



Stylized facts

- Deindustrialization in France

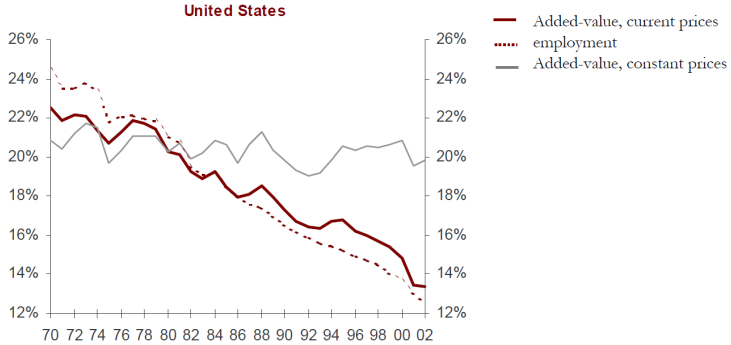
2. Part de l'industrie et de l'industrie manufacturière dans la valeur ajoutée totale : France : 1978-2004



Sources : CDC-IXIS et comptes trimestriels de l'INSEE.

Stylized facts

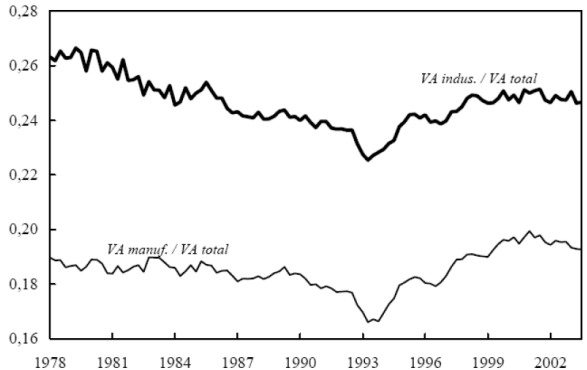
- At constant prices, deindustrialization is hardly visible



Stylized facts

- At constant prices, deindustrialization is hardly visible

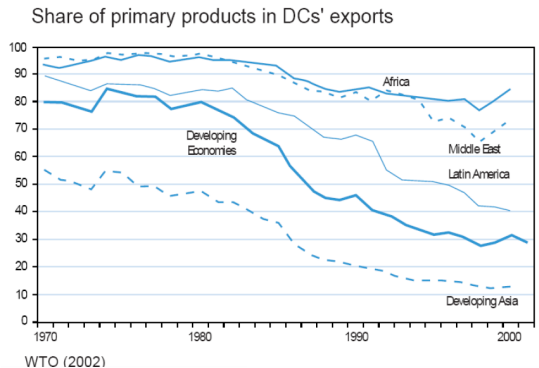
3. Part de l'industrie et de l'industrie manufacturière dans le volume de la valeur ajoutée totale : France : 1978-2004



Sources : CDC-IXIS et comptes trimestriels de l'INSEE.

Stylized facts

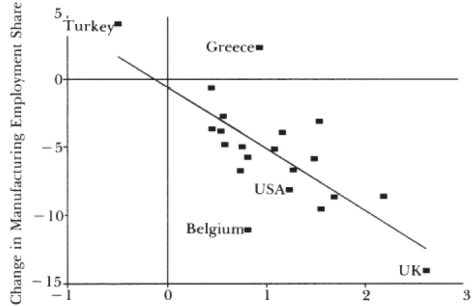
- Simultaneously, low-wage countries export more manufacturing goods



Stylized facts

- Deindustrialization and trade are clearly correlated

Deindustrialization and Developing-Country Import Penetration
(*OECD countries: percentage point changes from* 1970 *to* 1990)



Change in Net Imports of Manufactures from Developing Countries as Ratio of GDP

Source: Saeger (1995).

Wood (1995)

Stylized facts

Bottom line

1. Increasing inequality in developed countries, between skilled and unskilled workers
2. Industry share in employment is declining almost everywhere
3. At constant prices, the industrial value added is hardly declining (Hence this is a matter of relative prices)
4. Decline in relative industrial prices is correlated with the increase in the share of imports from emerging countries

$\rightarrow$ **All this seems to be in line with SS theorem**

Stylized facts

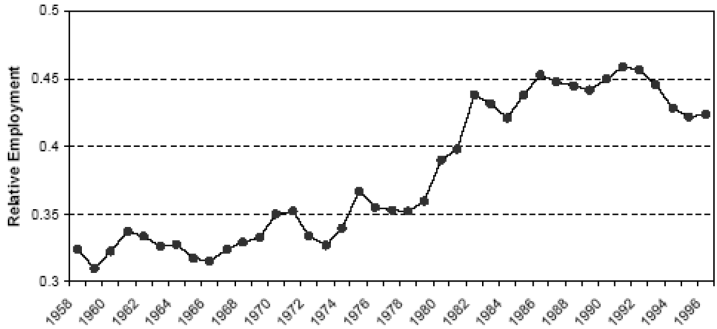
Correlation is not causality however... some facts don't match the SS story

- Wage inequality also rose in developing countries (Goldberg and Pavcnik, 2007)
  - Evidence on Mexico, Colombia, Argentina, India, Chile, Brazil, Hong Kong
  - Increases in the skill premium during 80s & 90s
  - Growing returns to university education

Stylized facts

2. The increase of wage-premium *should have led to a shift in employment away skilled workers*

This shift is not observed. More, Data go other way round!



Relative *employment* of non-production/production workers, U.S. manufacturing

Stylized facts

- Why is this at odds with SS?
  - To observe a decrease in both relative wage and relative employment of low skilled workers, it must be a positive shift in the demand for high skilled workers
  - This shift may be due to a change in outputs in favor of goods that are skilled-intensive

    $\rightarrow$ But we've seen that output (at constant price) did not change much
  - Hence, the increase in relative demand for skilled labor must have occurred **within industries** rather than between industries

Stylized facts

- Berman, Bound and Griliches (1994)
  - Decomposition of the change in relative employment within and between industries

Table 4.1. Industry Level Decomposition of the Change in the Share of Employment and Wages of Non-Production Workers, 1973-79 and 1979-87

All variables are in percentage changes per year

Year	Employment		Wages	
	Between	*Within*	*Between*	*Within*
1973-79	0.12	0.20	0.12	0.21
Total	*0.32*		*0.38*	
1979-1987	0.18	0.36	0.31	0.41
Total	*0.55*		*0.72*	

Relative employment and wages of non-prod workers increased

… but mainly within industries

Stylized facts

- Price movements are at odds with SS predictions
  - SS: relative price of skilled labor would increases if relative price of skill-intensive goods also increased
  - Lawrence and Slaughter (1993) and Lawrence (1994) collected production and import prices for 2 or 3-digit industries
  - The price movement that could have explained the rise of inequality through a SS effect is a larger increase of prices in skilled-intensive industries

We have observed the opposite!

Stylized facts

Industries that use the most production (i.e. unskilled workers) are those with the highest price increase

… or the lowest decrease

According to Stolper-Samuelson theorem, we should have observed a *rise* in unskilled relative wage

Table 4.2. Employment –Weighted Percentage Changes in Domestic and Import Prices

	Domestic Price	Import Price
United States (1980-89)		
All manufacturing industries		
Nonproduction labor weights	33.1	26.0
Production labor weights	32.3	28.1
Japan (1980-90)		
All manufacturing industries		
Nonproduction labor weights	-5.6	-18.2
Production labor weights	-3.9	-17.3
-Without Office Machines		
Nonproduction labor weights	-7.1	-18.7
Production labor weights	-4.7	-17.5
-Also without Petroleum Products		
Nonproduction labor weights	-7.0	-18.5
Production labor weights	-4.7	-17.4
Germany (1980-90)		
All manufacturing industries		
Non-manual labor weights	24.0	15.2
Manual labor weights	26.0	17.1
-Without Office Machines		
Non-manual labor weights	24.8	15.4
Manual labor weights	26.2	17.1
-Also without Petroleum Products		
Non-manual labor weights	25.0	15.7
Manual labor weights	26.3	17.2

Note: The averages shown weigh each industry's price change by that industry's share of total manufacturing employment or nonproduction and non-manual workers, or production and manual workers. Industries are defined at the 3-digit SIC level for the U.S., and generally correspond to the 2-digit level for Japan and Germany.

Sources: Lawrence and Slaughter (1993, Tables 3 and 4) and Lawrence (1994, Table 4).

Stylized facts: summary

Bottom line

- Widening wage gap hardly explained by a SS effect
- Some trade economists (notably Lawrence, Krugman, Slaughter during the 90s) concluded that trade is not responsible for the observed rising inequality and accused an (exogenous) **skilled-biased technological change**

Does it really rule out trade's responsibility?

Stylized facts: summary

Does it really rule out trade's responsibility? Probably not...

- Trade may affect demand of labor within industries in we consider trade in intermediate inputs (**outsourcing**)
- Skilled-biased technological shock may be related to competitive pressure resulting from trade openness
- New new trade theories and quality upgrading

Offshoring: theory

Outsourcing: Real world examples

Real world provides many examples of rising outsourcing strategies

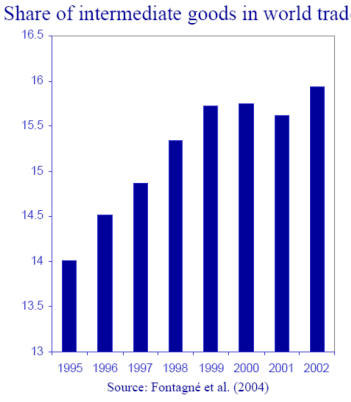
- IKEA: network of 2700 furniture subcontractors located in 67 countries. These firms receive product designs, leased equipment, and technical assistance from IKEA
- Benetton: over 95% of total activity (manufacturing and sales) is sub-contracted to more than 350 small, mostly Italian firms. Benetton uses 80 independent agents to manage over 4,000 independently owned stores
- H&M has 22 production offices all around the world. They coordinate about 700 independent subcontractors

Outsourcing

Outsourcing is also visible in trade data

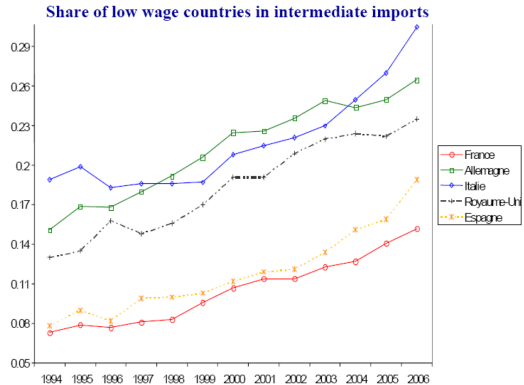
→Trade in intermediate good increases (rising outsourcing)

→ Intermediate goods represent about 16% of the world trade

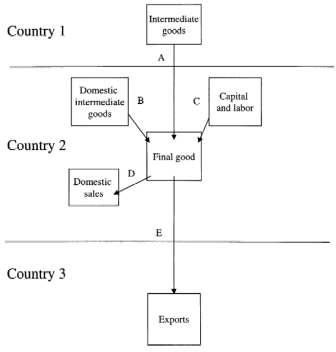


Outsourcing

Low wage countries have a growing share in exports of intermediate goods



Outsourcing



Hummels et al. (JIE, 2001): index of vertical specialization

Vertical specialization occurs when:

1 - A good is produced in two or more sequential stages

2 - Two or more countries provide value-added during the production of the good

3 - At least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported.

Measuring vertical specialization

Indicator of vertical specialization

$$VS_{ki} = \left(\frac{\text{Imported Intermediates}}{\text{Gross Output}}\right) * \text{Exports} = \left(\frac{\text{Exports}}{\text{Gross Output}}\right) * \text{Imported Intermediates}$$

For country 2 in the figure above, $VS_{2k} = \left(\frac{A}{D+E}\right) \times E$

$\rightarrow$ Imported inputs content of exports, or foreign value-added embodied in exports

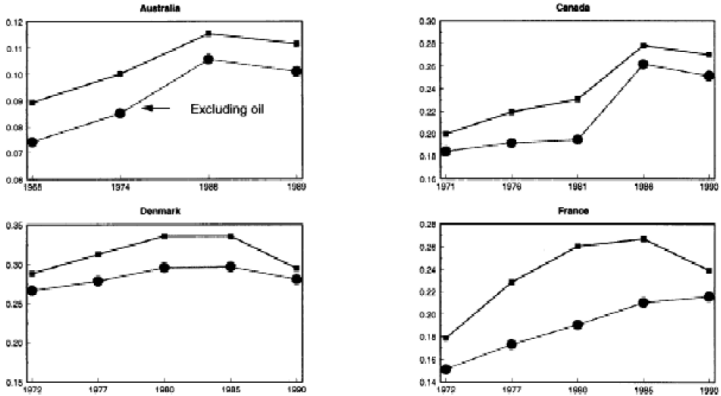
Aggregating over all industries k, we get a single indicator for each country i

$$\frac{VS_i}{X_i} = \frac{\sum_k VS_{ki}}{\sum_k X_{ki}},$$

where X denotes exports

Outsourcing

- They use IO tables for 10 OECD countries, to get imports content of exports for 35 sectors
- Their indicator increases for most countrv



Outsourcing: A simple model

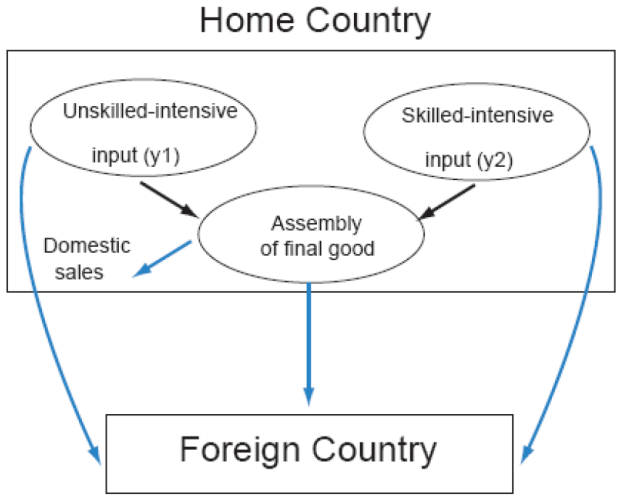
This model is described in Feenstra, chapter 4

- Introduces the possibility of trading intermediates with countries having very different relative prices (developing countries)
- Terminology: outsourcing $\neq$ offshoring
- Assume that within any industry, three activities take place

Outsourcing: A simple model

1. Production of an *unskilled labor intensive* input y_1 (e.g. producing components)
2. Production of a *skilled labor intensive* input y_2 (e.g. design, marketing, R&D, etc.)
3. (Costless) assembly of these inputs into a finished product
   - y_1 and y_2 produced at home *and* traded
   - Assume incomplete specialization: activities always performed at home (no corner solution)

Outsourcing: A simple model



Outsourcing: A simple model

- 3 factors of productions: unskilled labor (L_i), skilled labor (H_i) and capital (K_i)
- Concave, linearly homogeneous production functions

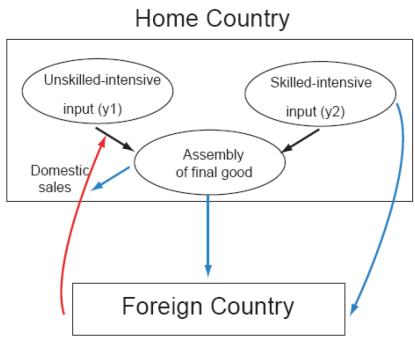
$$y_i = f_i(L_i, H_i, K_i) \qquad (1)$$

- Two countries Home and Foreign
- Home has a comparative advantage in activity 2, Foreign in activity 1

$\rightarrow$ "**Process fragmentation**": certain activities can be imported ("offshored") or exported

Outsourcing: A simple model

- For simplicity, we assume the country imports input 1 and exports input 2



Outsourcing: A simple model

Note

- $x_1 < 0$: imports of input 1, $x_2 > 0$: exports of input 2
- p_i the price of each input $i = 1, 2$ (price vector $p = (p_1, p_2)$)
- Production of the final good: $y_n = f_n(y_1 - x_1, y_2 - x_2)$
- Price of the final good p_n

Outsourcing: A simple model

Factor constraints / full employment:

$$\begin{aligned} L_1 + L_2 &= L_n \\ H_1 + H_2 &= H_n \\ K_1 + K_2 &= K_n \end{aligned} \qquad (2)$$

With perfect competition, the value of output from the final plus net trade will be maximized

$$G_n(L_n, H_n, K_n, p, p_n) \equiv \max p_n f_n(y_1 - x_1, y_2 - x_2) + p_1 x_1 + p_2 x_2$$

subject to the resource constraints (1) and (2)

Outsourcing: A simple model

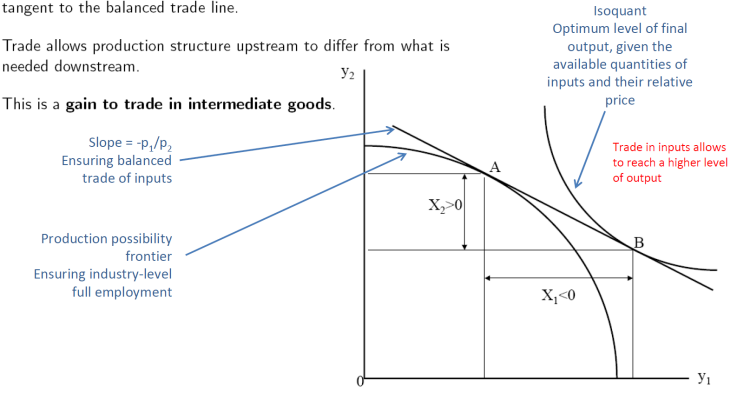
- Trade not necessarily balanced (partial equilibrium)
- But for illustration assume that $p_1 x_1 + p_2 x_2 = 0$

Outsourcing: A simple model

At initial world prices industry produces at point A.
Home exports intermediate good 2.
Home imports intermediate good 1.
Output of the final good is maximised on the isoquant that is tangent to the balanced trade line.

Trade allows production structure upstream to differ from what is needed downstream.

This is a **gain to trade in intermediate goods**.



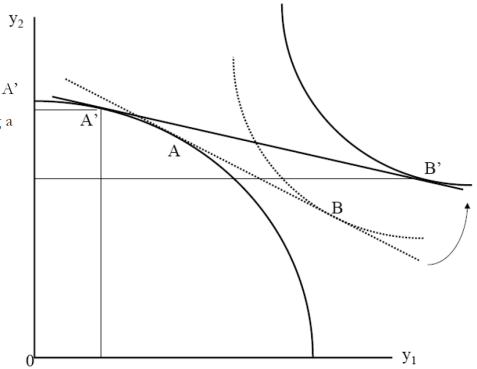
Outsourcing: A simple model

Now assume a decrease in p_1/p_2 (relative price of imported input)

- Industry shifts production toward skilled labor intensive activity at point A'
- Economy trads to point B' obtaining a higher output

→**Specific gain to outsourcing (similar to ToT gain)**

→What impact on factors prices?



Outsourcing: A simple model

Zero profit conditions:

$$p_i = c_i(w, q, r) \qquad (3)$$

(must hold for the locally produced inputs to be competitive at international prices)

We have

$$\widehat{p_1} = \theta_{1L}\widehat{w} + \theta_{1H}\widehat{q} + \theta_{1K}\widehat{r}$$

$$\widehat{p_2} = \theta_{2L}\widehat{w} + \theta_{2H}\widehat{q} + \theta_{2K}\widehat{r}$$

where θ_{ij} is the cost-share of factor j in activity i with $\sum_j \theta_{ij} = 1$

Outsourcing: A simple model

We'll treat $\widehat{p_i}$ as exogenous. Two equations, three unknown... problem

Assume $\theta_{1K} = \theta_{2K}$

We have: $\widehat{p_1} - \widehat{p_2} = (\theta_{1L} - \theta_{2L})\widehat{w} + (\theta_{1H} - \theta_{2H})\widehat{q}$

Moreover, $(\theta_{1L} - \theta_{2L}) = -(\theta_{1H} - \theta_{2H})$ (why?)

So finally, $\widehat{p_1} - \widehat{p_2} = (\theta_{1L} - \theta_{2L})(\widehat{w} - \widehat{q})$

$\rightarrow$ **A decrease in relative price of imported intermediates leads to a decrease in the relative wage of unskilled labor**

Outsourcing: A simple model

- Extension of SS theorem to the consequence of outsourcing
- *Within* industry factor price change

Outsourcing: A simple model

Second effect: **the price of the final good relative to imported input rises**

To see that note that: $\widehat{p_n} = \theta_{n1}\widehat{p_1} + \theta_{n2}\widehat{p_2}$

$\rightarrow$ change in the price of final good is a weighted average of the change in input prices

Outsourcing: A simple model

Second effect: **the price of the final good relative to imported input rises**

$\rightarrow$ We should compare import and domestic prices *within industries* rather than between industries

For example, competitiveness gains of German firms: obtained through increasing output content in imported inputs, traded at increasingly lower prices through outsourcing of activities previously done in Germany

Outsourcing: Model with a continuum of inputs

See also Feenstra

- One can develop a model with a continuum of inputs
- Counterintuitive prediction: relative wage of skilled labor rises in both countries

Why?

(evidence in line with this: Zhu and Trefler (2005))

Outsourcing: Effect on wages

Important: offshoring **does not** mean decrease in real wages of unskilled workers

$\rightarrow$ Offshoring acts as a productivity gain: allows a firm to produce a given good with fewer workers... no clear prediction

$\rightarrow$ Offshoring as technological change

See Baldwin and Robert Nicoud (2010), Grossman and Rossi-Hansberg (2008)

Offshoring: evidence

Outsourcing and wages: Evidence

Feenstra and Hanson (2003) “Global production sharing and rising inequality: a survey of trade and wages”

Feenstra and Hanson (1999) “The impact of outsourcing and high technology capital on wages: estimates for the US, 1979-1990” QJE

- Show that the impact of outsourcing of wages is comparable to a technological shock
- Want to estimate the relative influence of outsourcing and technology on wage inequality

Outsourcing and wages: Evidence

Derive from their model the following equation:

$$\Delta s_{Hm} = \phi_{0+}\phi_K \Delta K_m + \phi_Y \Delta Y_m + \phi'_z \Delta z_m \qquad m = 1, ..., M$$

where Δ denotes variable changes (difference between two years), and

- m stands for industries
- s_{Hm} is the wage share of skilled labor in industry m
- K is invested capital, Y is output
- and z is a set of variables that may shift costs... including outsourcing and technological variables

Outsourcing and wages: Evidence

Data

- 447 industries in US manufacturing, 1979-1990
- NBER productivity database
- Use non-production labor as a proxy for skilled labor
- **Outsourcing proxy**: share of imported inputs in total intermediate inputs by industry
- **Technical change proxy**: share of computer in capital stock

Outsourcing and wages: Evidence

Proxies

- **Share of intermediates** computed using IO tables and US imports data, then summed over all intermediate inputs to get the total share of imported input by industry
  - If the automobile industry purchases 10% of its inputs from steel industry and 30% of the steel consumed in the US is imported then it is assumed that 3% of inputs in auto is due to imported steel
- **Technological change**: share of computers and other technological goods in capital stock

Outsourcing and wages: Evidence

Dependent variable: 1979-90 change in non-production cost share

	(1)	(2)	(3)	Contribution
dln/(K/Y)	0.05	0.04	0.04	7 – 9 %
	(0 .01)	(0.01)	(0.009)	
dlnY	0.02	0.02	0.01	4 – 8%
	(0.006)	(0.006)	(0.006)	
Outsourcing	**0.20**	**0.22**	**0.14**	**15 – 24%**
	(0.10)	**(0.10)**	**(0.09)**	
Computer	0.20	0.43	(0.02)	13%
	(0.09)	(0.17)	(0.01)	
Other hi-tech	-0.07	0.005	0.02	0 – 3%
	(0.14)	(0.07)	(0.01)	
Constant	0.20	0.21	0.16	40 – 53%
	(0.04)	(0.04)	(0.05)	
R2	0.16	0.16	0.19	
N	447	447	447	

Source: Feenstra and Hanson

Outsourcing impacts positively the wage share of non-production workers.

Outsourcing and wages: Evidence

Dependent variable: 1979-90 change in non-production cost share

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dlnY	0.02	0.02	0.01	4 – 8%
	(0.006)	(0.006)	(0.006)	
Outsourcing	**0.20**	**0.22**	**0.14**	**15 – 24%**
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Technological changes also benefit to non-production workers.

Outsourcing and wages: Evidence

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Source: Feenstra and Hanson

Outsourcing matters at least as much as technological change

Outsourcing and wages: Evidence

Conclusions

- Impact on wage dispersion
- What about countries in the South?
  - Estimated for Mexico (Hanson and Harrison, 1999): even larger contribution to the increase in the cost-share of skilled labor (45%)

Acknowledgment

Slides of this course are inspired by those taught by N. Berman, T. Chaney, M. Crozet, D. Donaldson, T. Mayer, I. Mejean