Welcome…

International Outsourcing and Wage Rigidity: A Formal Approach and First Empirical Evidence

Daniel Horgos
(Helmut Schmidt University, Hamburg)

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Overview

- Introduction
- Theoretical Model (summary)
- Empirical Evidence
- Conclusions

Introduction

- "we live in an age of outsourcing"

  Grossman and Helpman (2005)

- main concerns in industrialized economies:
  - labor market disruptions

Introduction - literature

- theoretical contribution:
  - Feenstra and Hanson (1996, 1999)
  - Arndt (1997, 1998)
  - Glass and Saggi (2001)
  - Deardorff (2001)
  - Egger and Falkinger (2003)
  - Kohler (2008)
  - Grossman and Rossi-Hansberg (2009, forthcoming)
- all of them
  - assume flexible wage economies

Introduction - literature

- theoretical contributions with wage rigidity
  - Skaksen (2004)
  - Koskela and Stenbacka (2007)
  - Egger and Kreickemeier (2008)

- empirical contributions with wage rigidity
  - ?

Introduction - literature

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Theoretical Model: Non-Technical Summary

- 2x2 HO model
- bases on the modern duality approach
- introducing International Outsourcing similar than skill biased technical change (Jones 1965)

Theoretical Model: A Non-Technical Summary

- analyzing General Equilibrium Effects with flexible wages
  - relative wages
  - relative labor unit requirements
  - output
  - employment
- violating the flexible wage assumption
  - wage rigidity as in Brecher (1974)

Theoretical Model: A Non-Technical Summary

- results with flexible wages:
  - H industry outsourcing its L fragments → unit costs ↓
  - relative wages of the H ↑ (wages of the L ↓)
  - labor unit requirements of H ↓ (of the L ↑)
  - output:
    - H industry ↑ (outsourcing industry)
    - L industry ↓
  - employment:
    - H industry ↑ (outsourcing industry)
    - L industry ↓

Theoretical Model: A Non-Technical Summary

- Results with flexible wages:
  - H industry outsourcing its L fragments → unit costs ↓
  - relative wages of the H ↑ (wages of the L ↓)
  - labor unit requirements of H ↓ (of the L ↑)
  - output:
    - H industry ↑ (outsourcing industry)
    - L industry ↓
  - employment:
    - H industry ↑ (outsourcing industry)
    - L industry ↓

Theoretical Model: A Non-Technical Summary

- … and with wage rigidity:
  - L wages are fix!
  - H wages ↑ only in H industry
  - L industry stops production (labor movements)
  - L industry accepts the H wage premium and decreases output
    - H industry ↑ (outsourcing industry)
    - L industry ↓
  - employment:
    - L unemployment ↑
    - (since H industry can not absorb all L labor)

Theoretical Model: A Non-Technical Summary

- … and with wage rigidity:
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    - H industry ↑ (outsourcing industry)
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  - employment:
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Empirical Evidence

- empirical results are assumed to differ slightly
  - labor not completely mobile in the short run
  - short run adjustment patterns!

- expected results
  - in H industries
    - with flexible wages
      - unemployment of the L can ↑
    - with wage rigidity
      - unemployment of the L ↑ ↑ ↑ (much more stronger)
  - in L industries
    - unemployment of L ~~↑~~ (the wage floor is not binding)
  - more aggregated industries (whole economy, service sector)
    - ?

Empirical Evidence: Data and Econometric Methodology

- micro Economic Panel Data for Germany
- SOEP and input-output tables of the Stat. Office
- 1991 – 2000

- multiple logit model

$$U_{ijt} = \beta_0 + \beta_1 \mathrm{VS}_{jt} + \beta_2 Y_{jt} + \beta_3 \mathrm{age}_{it} + \beta_4 \mathrm{deast}_{it} + \beta_5 \mathrm{dmale}_{it} + \tau_j + \delta_t + \mu_i + \epsilon_{it}$$

Empirical Evidence: Wage Rigidity…

- indicator for wage rigidity…
  - following Holden and Wulfsberg (2004), Knoppik and Beissinger (2005), Goette et al. (2007), and Bauer et al. (2007)
  - Idea: compare two distributions…
    - "empirical distribution" of wage changes in an industry
    - "notional normalized distribution" of wage changes
- in detail …

Empirical Evidence: Wage Rigidity…

- calculate the percentage change of mean wages of L per 2-digit NACE industry $\hat{w}_{it}$
- empirical distribution:
  - industry-year samples are stochastic: uncertainty
  - … bootstrap… the empirical distribution
  - calculate the probability of wage cuts
- notional normalized distribution
  - normalize the distribution of wage changes $\hat{w}_{it}^{n} \equiv \frac{\hat{w}_{it} - \mu(\hat{w})_i}{sd(\hat{w})_i}$
  - adjusting with bootstrapped mean and sd $\tilde{w}_{it} \equiv \hat{w}_{it}^{n} sd^{B} + \mu^{B}$
  - calculate the probability of wage cuts

Empirical Evidence: Wage Rigidity…

- compare
  - empirically observed probability of wage cuts
  - notional normalized probability of wage cuts

- if empirical < notional normalized

wage rigidity

Empirical Evidence: Results

... the results ...

Empirical Evidence: Results

Table 5.1: Effects on Unemployment of the Low Skilled

in	Whole Economy		Service Industry	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS				
Y				
age				
d East Ger.				
d Male				
cons				
Observations				
Groups				
Prob > chi2				
Industry Controls				
Year Controls				
Region Controls				

(z-Statistics in parantheses)
* / ** / *** significant at 10 / 5 / 1 percent

Empirical Evidence: Results

Table 5.1: Effects on Unemployment of the Low Skilled

in	Whole Economy		Service Industry	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	12.7423			
	(1.60)			
Y	4.75e-06			
	(1.50)			
age	−.0551***			
	(−10.79)			
d East Ger.	.2544*			
	(1.64)			
d Male	−.3102**			
	(2.33)			
cons	−3.0526***			
	(−3.59)			
Observations	16, 194			
Groups	5, 039			
Prob > chi2	0.0000			
Industry Controls	YES			
Year Controls	YES			
Region Controls	YES			

(z-Statistics in parantheses)
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Empirical Evidence: Results

Table 5.1: Effects on Unemployment of the Low Skilled

in	Whole Economy		Service Industry	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	12.7423	25.8744***		
	(1.60)	(2.46)		
Y	4.75e-06	−2.66e-06		
	(1.50)	(−.42)		
age	−.0551***	−.0546***		
	(−10.79)	(−9.27)		
d East Ger.	.2544*	−.2107		
	(1.64)	(1.15)		
d Male	−.3102**	−.3272**		
	(2.33)	(−2.21)		
cons	−3.0526***	−5.2270***		
	(−3.59)	(−3.66)		
Observations	16, 194	13, 195		
Groups	5, 039	4, 173		
Prob > chi2	0.0000	0.0000		
Industry Controls	YES	YES		
Year Controls	YES	YES		
Region Controls	YES	YES		

(z-Statistics in parantheses)
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Empirical Evidence: Results

Table 5.1: Effects on Unemployment of the Low Skilled

in	Whole Economy		Service Industry	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	12.7423	25.8744***	27.7687	
	(1.60)	(2.46)	(1.56)	
Y	4.75e-06	−2.66e-06	−5.55e-06	
	(1.50)	(−.42)	(−.91)	
age	−.0551***	−.0546***	−.0583***	
	(−10.79)	(−9.27)	(−9.18)	
d East Ger.	.2544*	−.2107	.2281	
	(1.64)	(1.15)	(1.31)	
d Male	−.3102**	−.3272**	−.0518	
	(2.33)	(−2.21)	(−.32)	
cons	−3.0526***	−5.2270***	−1.5433	
	(−3.59)	(−3.66)	(−1.13)	
Observations	16, 194	13, 195	15, 345	
Groups	5, 039	4, 173	4, 492	
Prob > chi2	0.0000	0.0000	0.0000	
Industry Controls	YES	YES	YES	
Year Controls	YES	YES	YES	
Region Controls	YES	YES	YES	

(z-Statistics in parantheses)
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Empirical Evidence: Results

Table 5.1: Effects on Unemployment of the Low Skilled

in	Whole Economy		Service Industry	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	12.7423	25.8744***	27.7687	41.3825*
	(1.60)	(2.46)	(1.56)	(1.83)
Y	4.75e-06	−2.66e-06	−5.55e-06	−1.37e-05
	(1.50)	(−.42)	(−.91)	(−1.39)
age	−.0551***	−.0546***	−.0583***	−.0610***
	(−10.79)	(−9.27)	(−9.18)	(−7.59)
d East Ger.	.2544*	−.2107	.2281	.1278
	(1.64)	(1.15)	(1.31)	(.59)
d Male	−.3102**	−.3272**	−.0518	−.0272
	(2.33)	(−2.21)	(−.32)	(−.14)
cons	−3.0526***	−5.2270***	−1.5433	−3.3119***
	(−3.59)	(−3.66)	(−1.13)	(−2.45)
Observations	16, 194	13, 195	15, 345	7, 489
Groups	5, 039	4, 173	4, 492	2, 432
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Industry Controls	YES	YES	YES	YES
Year Controls	YES	YES	YES	YES
Region Controls	YES	YES	YES	YES

(z-Statistics in parantheses)
* / ** / *** significant at 10 / 5 / 1 percent

Empirical Evidence: Results

Table 5.2: Effects on Unemployment of the Low Skilled

in	High Skill Industries		Low Skill Industries	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS				
Y				
age				
d East Ger.				
d Male				
cons				
Observations				
Groups				
Prob > chi2				
Industry Controls				
Year Controls				
Region Controls				

(z-Statistics in parantheses)
* / ** / *** significant at 10 / 5 / 1 percent

Empirical Evidence: Results

Table 5.2: Effects on Unemployment of the Low Skilled

in	High Skill Industries		Low Skill Industries	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	36.8284*			
	(1.68)			
Y	9.78e-07			
	(.08)			
age	−.0702***			
	(−4.18)			
d East Ger.	.3054			
	(.56)			
d Male	−.1085			
	(−.28)			
cons	−9.2156**			
	(−1.95)			
Observations	2,768			
Groups	1,018			
Prob > chi2	0.0120			
Industry Controls	YES			
Year Controls	YES			
Region Controls	YES			

(z-Statistics in parantheses)
* / ** / *** significant at 10 / 5 / 1 percent

Empirical Evidence: Results

Table 5.2: Effects on Unemployment of the Low Skilled

in	High Skill Industries		Low Skill Industries	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	36.8284*	61.0233**		
	(1.68)	(2.16)		
Y	9.78e-07	−4.25e-06		
	(.08)	(−.32)		
age	−.0702***	−.0676***		
	(−4.18)	(−4.03)		
d East Ger.	.3054	.3714		
	(.56)	(.69)		
d Male	−.1085	−.0234		
	(−.28)	(.06)		
cons	−9.2156**	−12.7672**		
	(−1.95)	(−2.18)		
Observations	2,768	2,738		
Groups	1,018	1,003		
Prob > chi2	0.0120	0.0043		
Industry Controls	YES	YES		
Year Controls	YES	YES		
Region Controls	YES	YES		

(z-Statistics in parantheses)
* / ** / *** significant at 10 / 5 / 1 percent

Empirical Evidence: Results

Table 5.2: Effects on Unemployment of the Low Skilled

in	High Skill Industries		Low Skill Industries	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	36.8284*	61.0233**	−4.5951	
	(1.68)	(2.16)	(−.21)	
Y	9.78e-07	−4.25e-06	1.14e-04*	
	(.08)	(−.32)	(1.69)	
age	−.0702***	−.0676***	−.0616***	
	(−4.18)	(−4.03)	(−4.64)	
d East Ger.	.3054	.3714	.3779	
	(.56)	(.69)	(.80)	
d Male	−.1085	−.0234	−.6600**	
	(−.28)	(.06)	(−2.16)	
cons	−9.2156**	−12.7672**	−17.2181*	
	(−1.95)	(−2.18)	(−1.72)	
Observations	2,768	2,738	3,042	
Groups	1,018	1,003	1,085	
Prob > chi2	0.0120	0.0043	0.0330	
Industry Controls	YES	YES	YES	
Year Controls	YES	YES	YES	
Region Controls	YES	YES	YES	

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Empirical Evidence: Results

Table 5.2: Effects on Unemployment of the Low Skilled

in	High Skill Industries		Low Skill Industries	
considering	all industries	rigid wage industries	all industries	rigid wage industries
VS	36.8284*	61.0233**	−4.5951	−6.0987
	(1.68)	(2.16)	(−.21)	(−.29)
Y	9.78e-07	−4.25e-06	1.14e-04*	7.77e-05
	(.08)	(−.32)	(1.69)	(1.05)
age	−.0702***	−.0676***	−.0616***	−.0569***
	(−4.18)	(−4.03)	(−4.64)	(−4.29)
d East Ger.	.3054	.3714	.3779	.4915
	(.56)	(.69)	(.80)	(1.04)
d Male	−.1085	−.0234	−.6600**	−.6916**
	(−.28)	(.06)	(−2.16)	(−2.22)
cons	−9.2156**	−12.7672**	−17.2181*	−12.8314
	(−1.95)	(−2.18)	(−1.72)	(−1.16)
Observations	2,768	2,738	3,042	2,802
Groups	1,018	1,003	1,085	1,006
Prob > chi2	0.0120	0.0043	0.0330	0.0238
Industry Controls	YES	YES	YES	YES
Year Controls	YES	YES	YES	YES
Region Controls	YES	YES	YES	YES

(z-Statistics in parantheses)
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Conclusions

- theoretical models of International Outsourcing
  - most of them consider flexible wage economies
  - no empirical evidence

International Outsourcing and Wage Rigidity:
A Formal Approach and First Empirical Evidence

Conclusions

- logit model (micro data: SOEP)
- Results:
  - rigid wage industries: unemployment of the L ↑ ↑ ↑
- to blame:

~~International Outsourcing~~

inflexible labor market institutions

Thank You for Your Attention…

International Outsourcing and Wage Rigidity: A Formal Approach and First Empirical Evicence

Daniel Horgos

Helmut Schmidt University, Hamburg
horgos@hsu-hh.de

Back up

Model Set Up - Summary

- unit costs equal the price

$$c_X = a_{XL}w_L + a_{XH}w_H = p$$

$$c_Y = a_{YL}w_L + a_{YH}w_H = 1$$

Model Set Up - Summary

- Shephard's Lemma
  … to solve for Labor Unit Requirements

$$a_{XL} = \frac{\partial c_X(w_L, w_H)}{\partial w_L}$$

$$a_{XH} = \frac{\partial c_X(w_L, w_H)}{\partial w_H}$$

$$a_{YL} = \frac{\partial c_Y(w_L, w_H)}{\partial w_L}$$

$$a_{YH} = \frac{\partial c_Y(w_L, w_H)}{\partial w_H}$$

Model Set Up - Summary

- Factor market equilibrium conditions

$$L = a_{XL}q_X + a_{YL}q_Y = \bar{L}$$
$$H = a_{XH}q_X + a_{YH}q_Y = \bar{H}$$

Model Set Up - International Outsourcing

- Introducing International Outsourcing
  - similar than technical progress as in Jones (1965)

$$\hat{\varphi}_{ij} \equiv -\frac{1}{a_{ij} \cdot \frac{\partial a_{ij}}{\partial IO}}$$

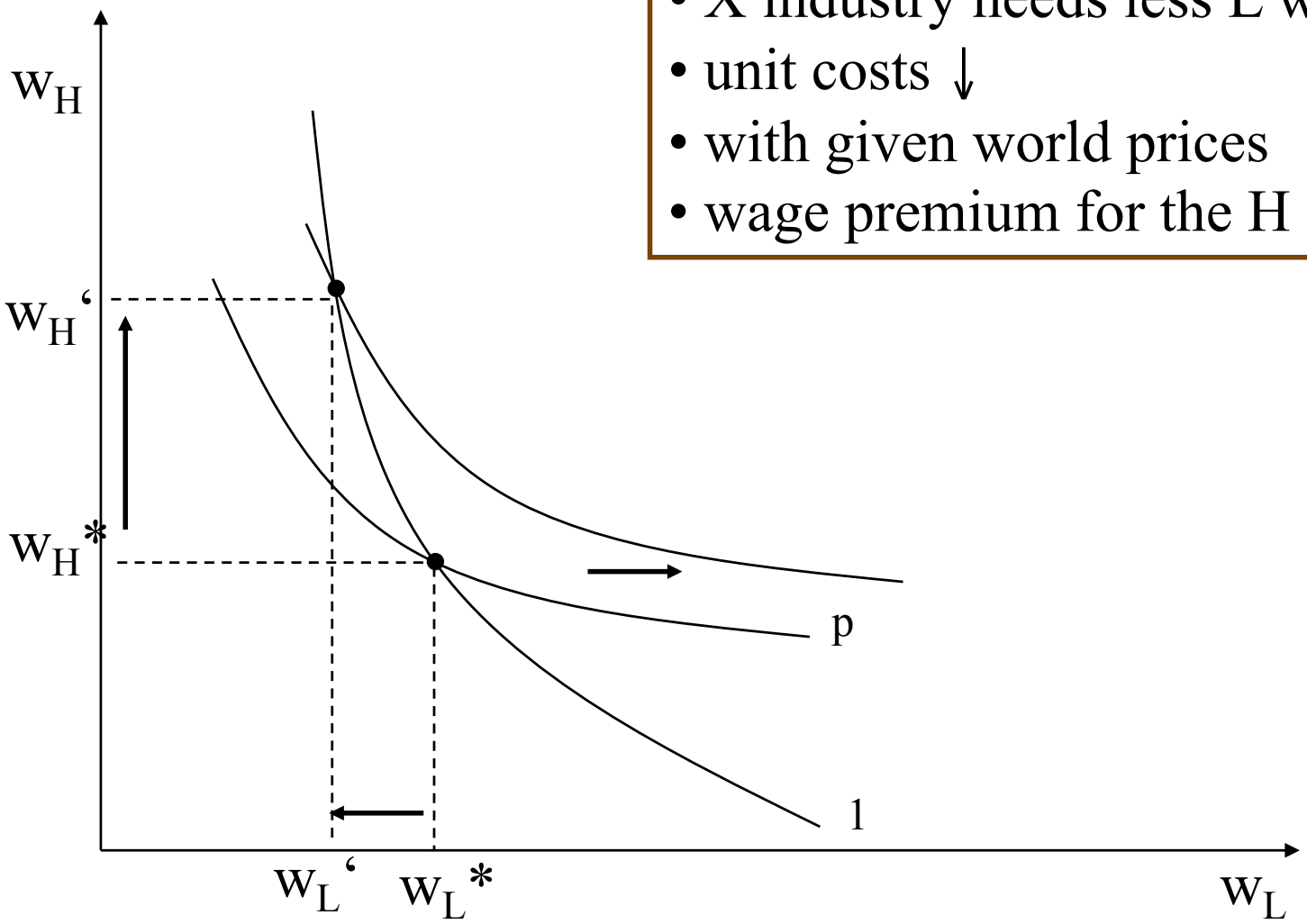
General Equilibrium Effects
- wages

- consider International Outsourcing
- … and take the total differential of the unit costs

$$\theta_{XL}\hat{w}_L + \theta_{XH}\hat{w}_H = \theta_{XL}\hat{\varphi}_{XL} + \theta_{XH}\hat{\varphi}_{XH}$$
$$\theta_{YL}\hat{w}_L + \theta_{YH}\hat{w}_H = \theta_{YL}\hat{\varphi}_{YL} + \theta_{YH}\hat{\varphi}_{YH}$$

General Equilibrium Effects
- wages

- X industry needs less L workers
- unit costs ↓
- with given world prices
- wage premium for the H



General Equilibrium Effects
- summary

- International Outsourcing of the L Parts in X
- unit costs ↓
- with fixed world prices → profit ↑
- wage premium for H / L wages ↓

- relative labor unit requirements of the H ↓
- skill shift toward more L labor

General Equilibrium Effects
- summary

- the “outsourcing” industry gets more competitive
- X output ↑, Y output ↓

- employment in X ↑ (H and L)
- employment in Y ↓ (H and L)

Wage Floor for Low Skilled Labor

- introducing wage floor for L as in Brecher (1974)
- min real wage $\bar{w}_L$ (set before IO takes place)
- at $\bar{w}_L$: L is fully employed
- but with downward inflexibility of the real wage

$$w_L \geq \bar{w}_L \text{ or } \hat{w}_L \geq 0$$

Wage Floor for Low Skilled Labor
- wages

- remember…

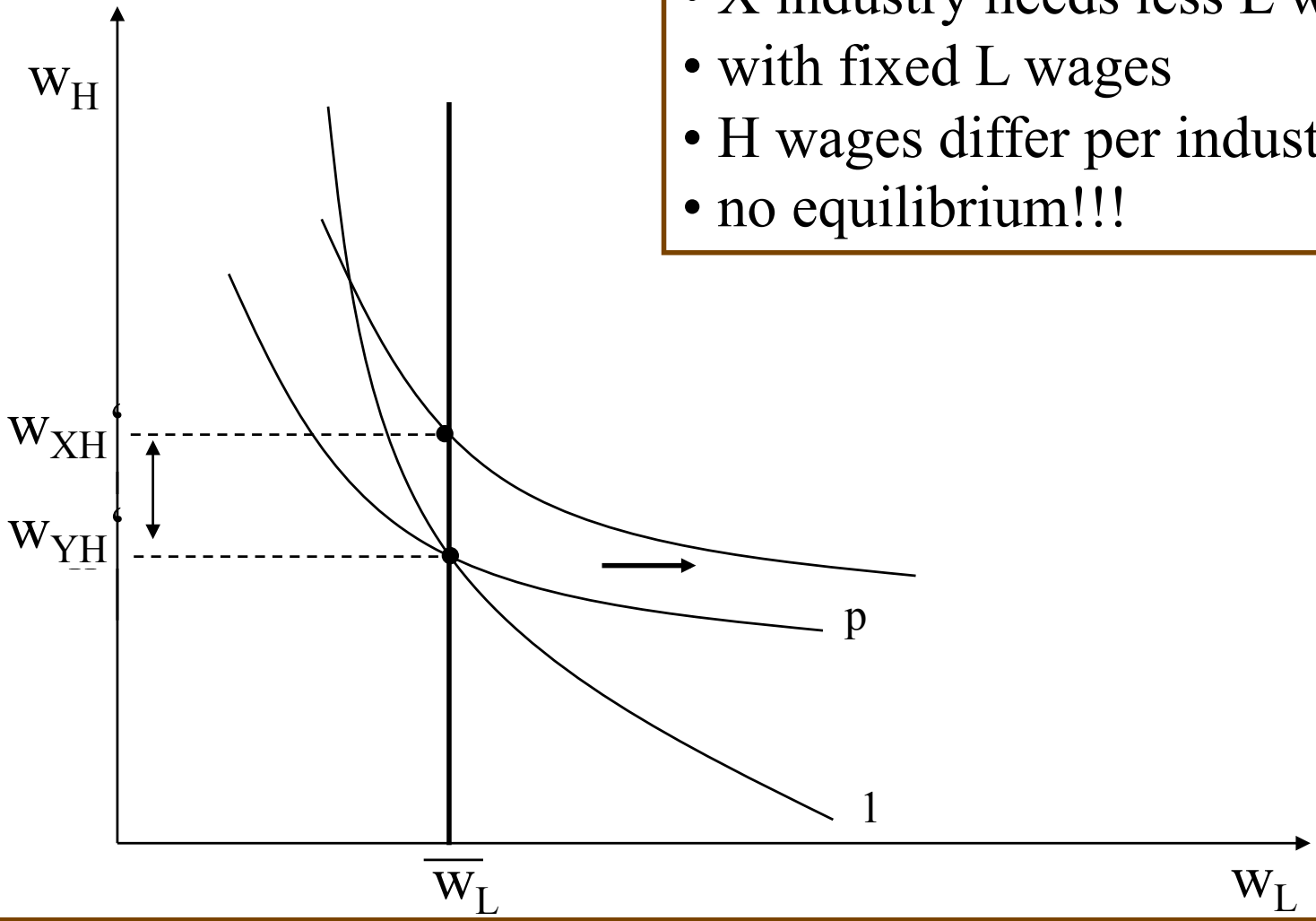
$$\hat{w}_L = -\frac{\theta_{XL}\theta_{YH}}{\Delta_\Theta}\hat{\varphi}_{XL}$$

- the min wage is binding!

$$\hat{w}_L = 0$$

General Equilibrium Effects
- wages

- X industry needs less L workers
- with fixed L wages
- H wages differ per industry
- no equilibrium!!!



Wage Floor for Low Skilled Labor
- wages

- 2. Step:
  - the Y industry has to accept the H wage premium
  - by setting L free (to decrease output)

$$\hat{w}_H = \hat{w}_{XH} = \hat{w}_{YH} = \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL}$$

- … and for relative wages:

$$\hat{w}_H - \hat{w}_L = \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} > 0$$

- rel. H wages ↑
- but not as strong!

Wage Floor for Low Skilled Labor
- labor unit requirements

- … and for labor unit requirements

$$\hat{a}_H - \hat{a}_L = -\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL}$$

- again: skill shift towards L
- but not as strong!

Wage Floor for Low Skilled Labor
- output

- with wage rigidity: unemployment gets possible

$$\hat{q}_X = \frac{\lambda_{YL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{YH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda} \cdot \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} + \frac{\lambda_{YH}}{\Delta_\Lambda}\hat{U}_L$$

$$\hat{q}_Y = -\frac{\lambda_{XL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{XH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda} \cdot \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \frac{\lambda_{XH}}{\Delta_\Lambda}\hat{U}_L$$

- X output (outsourcing) ↑
- Y output ↓
- but due to 2 different forces:
  1, „normal“ change of Outsourcing
  2, additional reduction of L in the Y industry

Wage Floor for Low Skilled Labor - employment

- again: remember full employment conditions…

$$
\begin{aligned}
\hat{L}_X &= \frac{\theta_{YH}}{\Delta_\Theta}\frac{\Delta_\Lambda}{\lambda_{YL}}\theta_{XL}\hat{\varphi}_{XL} + \frac{\lambda_{XH}+\theta_{YL}\lambda_{YH}+\theta_{YH}\lambda_{YH}}{\theta_{XH}}\theta_{XL}\hat{\varphi}_{XL} - \frac{\lambda_{YH}}{\lambda_{YL}}\hat{L}_Y \\
\hat{L}_Y &= -\frac{\theta_{YH}}{\Delta_\Theta}\frac{\Delta_\Lambda}{\lambda_{XL}}\theta_{XL}\hat{\varphi}_{XL} + \frac{\lambda_{XL}(\lambda_{XH}+\theta_{YL}\lambda_{YH})+\lambda_{XH}(\theta_{YH}\lambda_{YL})}{\lambda_{XL}\theta_{XH}}\theta_{XL}\hat{\varphi}_{XL} \\
&\quad -\frac{\lambda_{XH}}{\lambda_{XL}}\hat{L}_X \\
\hat{H}_X &= -\frac{\theta_{YL}}{\Delta_\Theta}\theta_{XL}\hat{\varphi}_{XL} + \frac{\lambda_{YL}(\lambda_{XH}+\theta_{YL}\lambda_{YH})+\lambda_{YH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda}\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} + \hat{U}_L\frac{\lambda_{YH}}{\Delta_\Lambda} \\
\hat{H}_Y &= -\frac{\theta_{YL}}{\Delta_\Theta}\theta_{XL}\hat{\varphi}_{XL} - \frac{\lambda_{XL}(\lambda_{XH}+\theta_{YL}\lambda_{YH})+\lambda_{XH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda}\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \hat{U}_L\frac{\lambda_{XH}}{\Delta_\Lambda}
\end{aligned}
$$

Wage Floor for Low Skilled Labor - employment

- unemployment of the L

$$\hat{U}_L = -(\lambda_{XH} + \theta_{YH}\lambda_{YH} + \theta_{YH}\lambda_{YL})\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \Delta_\Lambda(\hat{q}_Y - \hat{q}_X)$$

- reduces to…

$$\hat{U}_L = \hat{U}_L(\lambda_{XH} - \lambda_{YH})$$

Wage Floor for Low Skilled Labor
- summary

- with International Outsourcing and a wage floor
- H wages increase in X but not in Y
- complete specialization → no equilibrium
- Y industry has to accept H wage premium
- … and is forced to set L free
  (in order to decrease output)

Wage Floor for Low Skilled Labor
- summary

- relative wages of the H ↑
- skill shift toward L
- output in X ↑, output in Y ↓
- 2 forces:
  - "normal" effect of International Outsourcing
  - "additional" reduction of L
- move downward the Rybczynski line
- unemployment of the L ↑