Heterogenous worker in a unionized oligopoly

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Motivation

- Firms regularly employ heterogenous workers
- Literature concludes:
  - Substitutable workers are better off in one encompassing union
  - Complementary workers benefit being organized in different unions
- But: Literature always assumes homogenous bargaining strengths
- Focus of the paper:
  - Analyzing different organization and bargaining structures
  - Impact on wages, union utility, profits, and welfare
  - How should workers organize themselves: intra–union degree of heterogeneity vs. degree of centralization of the union
  - Craft unions, comprehensive unions vs. firm specific, industry wide, or even national unions

Literature

- Horn and Wolinsky (1988), *The Economic Journal*
- Dowrick (1993), *The Economic Record*
- Gürtzgen (2003), *Labour*

Assumptions

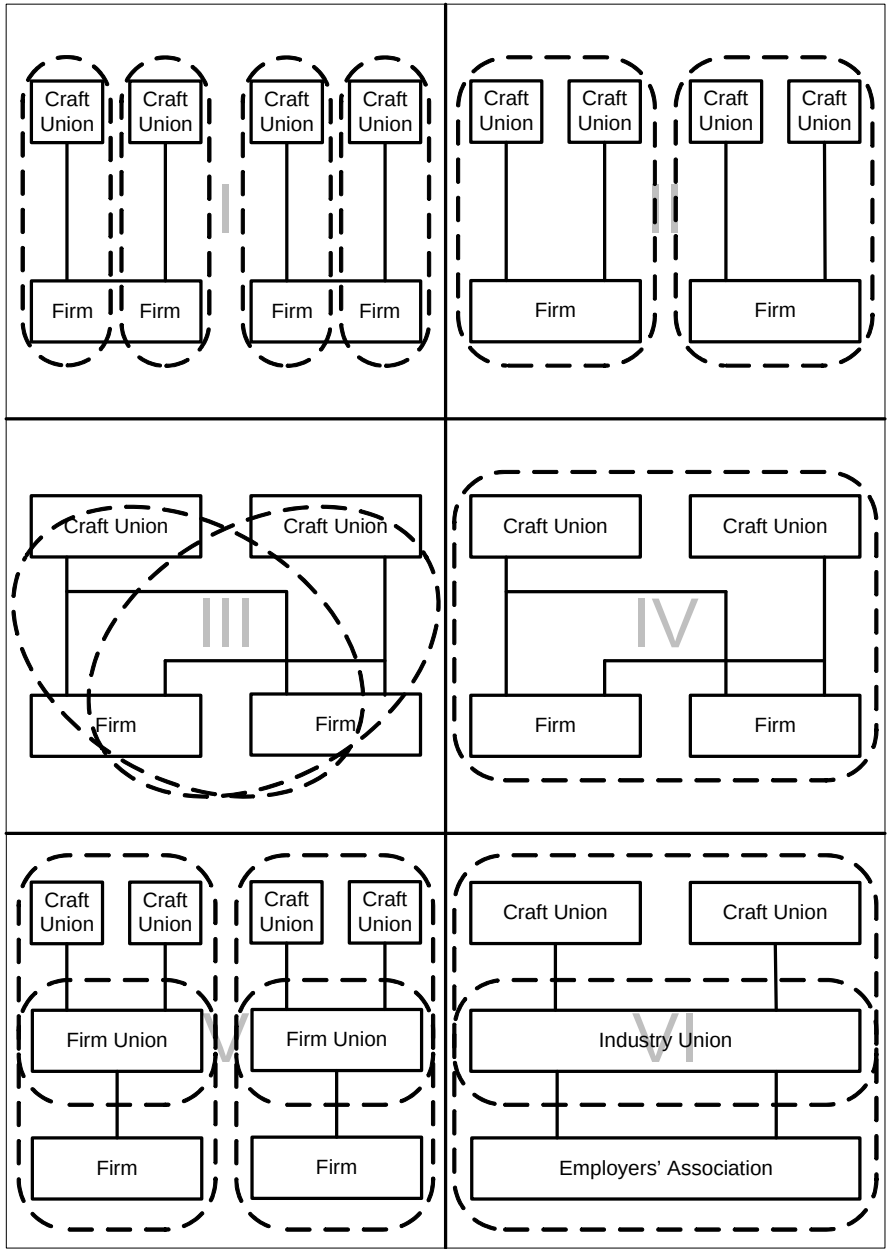
- two firms, four unions
- output: N workers of type n and M workers of type m
- costs: $c_i = Nw_{in} + Mw_{im}$ with $i = 1, 2$
- profit: $\pi_i = (p - c_i)x_i$ with $i = 1, 2$
- demand: $p = A - x_1 - x_2$
- unions: U_{1n}, U_{1m}, U_{2n}, and U_{2m}
- union utility $U_{i,j} = jw_{ij}x_i$ with $j = n, m$ and $i = 1, 2$

The game:

1. wage negotiations take place
2. firms set quantities in the product market

Negotiation Regimes

1. two negotiations in each firm, unions negotiate separately
2. one negotiation round for each firm, unions negotiate separately
3. two industry craft unions, each union bargains in one negotiation with both firms over industry wide craft wages
4. two industry craft unions, industry wide craft wages, one industry wide negotiation
5. two firm specific unions representing two different types of workers, one negotiation with each firm
6. one industry union negotiates with one employers' association


Craft Union
Firm
I
II
III
IV
Firm Union
V
Industry Union
VI
Employers' Association

Stylized Negotiations

Nash Bargaining Solution

- Case 2: $N = U_{in}^{a} U_{im}^{b} \pi_{i}^{c}$ with $i = 1, 2$
- Case 3: $N = U_{j}^{a} \pi_{1}^{c} \pi_{2}^{c}$ with $j = m, n$
- Case 5:
  1. two distinct crafts in one firm bargain for the internal distribution of rents. $\rightarrow$ relative wage $\beta = w_{in} / w_{im}$
  2. the merged union bargains with its firm over absolute wages.

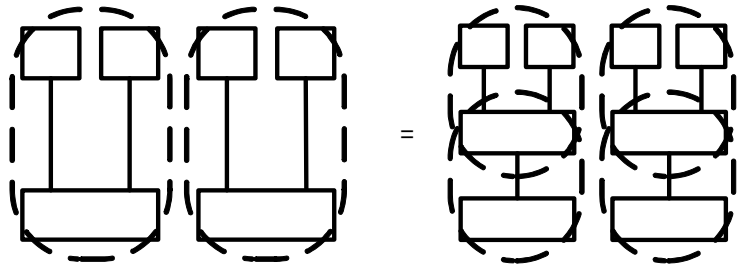
     $N_{1i} = U_{i}^{(a+b)} \pi_{i}^{c}$

     $N_{2i} = U_{in}^{a} U_{im}^{b}$

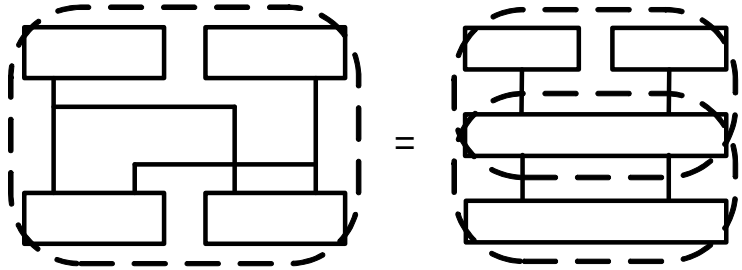
Results

Overview

- whether two craft unions merge or negotiate in one round with the firms does not matter:
  - *Case* 2 = *Case* 5



  - *Case* 4 = *Case* 6



- no decisive advise for complementary and substitutable workers

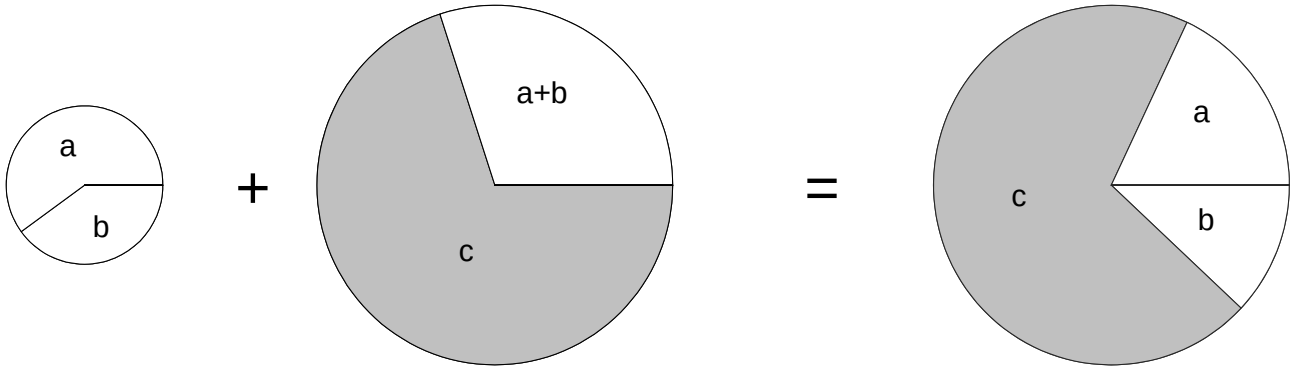
One negotiation vs. one union framework

Case 2: individual utility maximization, no internalization of the negative external effect of higher wages on craftworkers of the other craft in the same firm

$$\left[Nw_n x_i\right]^a \left[Mw_m x_i\right]^b \left[(p - Nw_{in} - Mw_{im})x_i\right]^c$$

Case 5: joint utility maximization, internalization of this external effect

$$\frac{\left[\left(Nw_n + Mw_m\right) x_i\right]^{(a+b)} \left[(p - Nw_{in} - Mw_{im})x_i\right]^c}{\left[Nw_n x_i\right]^a \left[Mw_m x_i\right]^b}$$

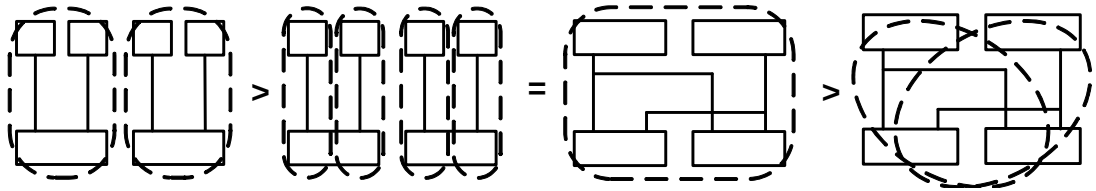


- negotiation strength of merged union has to be $a + b$
- negative externality is internalized through Nash Maximization
- empirical research showed this in Machin, Stewart, and van Reenen (1993) and Metcalf (1993) without an explanation

Direct and indirect effects

- direct effects on quantity:
  - own costs: $\frac{dx_i}{dw_{in}} < 0$, $\frac{dx_i}{dw_{im}} < 0$
  - competitors costs: $\frac{dx_i}{dw_{jn}} > 0$, $\frac{dx_i}{dw_{jm}} > 0$
- indirect effects on wages:
  - complementary workers, same firm: $\frac{dw_{in}}{dx_i}\frac{dx_i}{dw_{im}} < 0$
  - workers in a competing firm: $\frac{dw_{in}}{dx_i}\frac{dx_i}{dw_{jn}} > 0$, $\frac{dw_{in}}{dx_i}\frac{dx_i}{dw_{jm}} > 0$

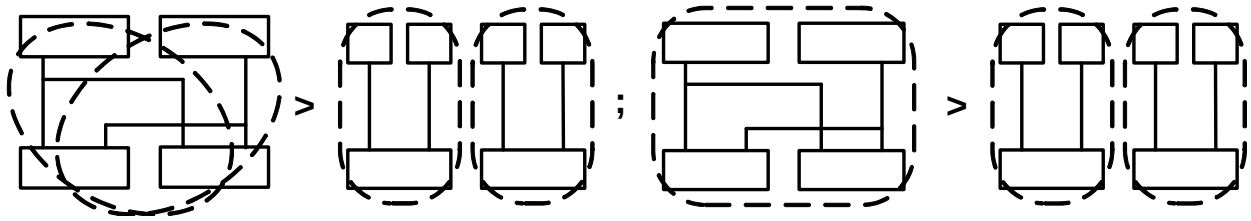
Quantity and firm profit



- $x_i^{II} > x_i^{I} \geq x_i^{IV} > x_i^{III}$
  - negative effect on the other craft internalized: $\longrightarrow$ higher quantity
  - positive external effect on the other firm not internalized: $\longrightarrow$ higher quantity
- $\pi_i^{II} > \pi_i^{I} \geq \pi_i^{IV} > \pi_i^{III}$

Wages

Unambiguous results

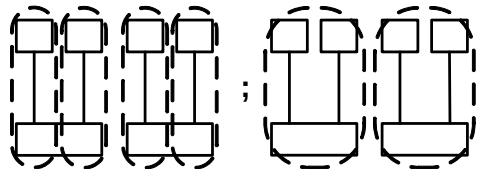


- $w_j^{III} > w_j^{II}$
- $w_j^{IV} > w_j^{II}$
- internalization of negative external wage effects in Case 2
- no internalization of positive external firm effects in Case 2

Wages

1. wages are ordered $w_j^{III} > w_j^{II}$ and $w_j^{IV} > w_j^{II}$ for $j = n, m$.
2. the comparison between w_j^{I} and w_j^{II}, w_j^{I} and w_j^{III}, w_j^{III} and w_j^{IV} is ambiguous and depends on a, b, and c.
3. for $a > b$, $w_n^{IV} > w_n^{I}$ and $w_m^{I} > w_m^{IV}$, analogously for $b > a$, $w_n^{IV} < w_n^{I}$ and $w_m^{I} < w_m^{IV}$. For $a = b$, $w_n^{IV} = w_n^{I}$ and $w_m^{IV} = w_m^{I}$.

Case 1 vs. Case 2



$w_n^I \overset{?}{>} w_n^{II}$

Case 1: $N = U_{1n}^a \pi_1^c$

$$\frac{dN}{dw_{1n}} = \underbrace{\frac{a}{U_{1n}} \frac{dU_{1n}}{dw_{1n}}}_{\text{direct effect}} + \underbrace{\frac{c}{\pi_1} \frac{d\pi_1}{dw_{1n}}}_{\text{firm effect}} \overset{!}{=} 0$$

Case 2: $N = U_{1n}^a U_{1m}^b \pi_1^c$

$$\frac{dN}{dw_{1n}} = \underbrace{\frac{a}{U_{1n}} \frac{dU_{1n}}{dw_{1n}}}_{\text{direct effect}} + \underbrace{\frac{b}{U_{1m}} \frac{dU_{1m}}{dw_{1n}}}_{\text{indirect effect}} + \underbrace{\frac{c}{\pi_1} \frac{d\pi_1}{dw_{1n}}}_{\text{firm effect}} \overset{!}{=} 0$$

Comparison of wages

- $w_{1n}^{I*}(w_{1m}, w_{2n}, w_{2m})$; $w_{1n}^{II*}(w_{1m}, w_{2n}, w_{2m})$ ▸ Opt. Wage
- evaluate $\frac{dN^I}{dw_{1n}} = 0$ at w_{1n}^{II*} using $\frac{dN^{II}}{dw_{1n}} = 0$ yields

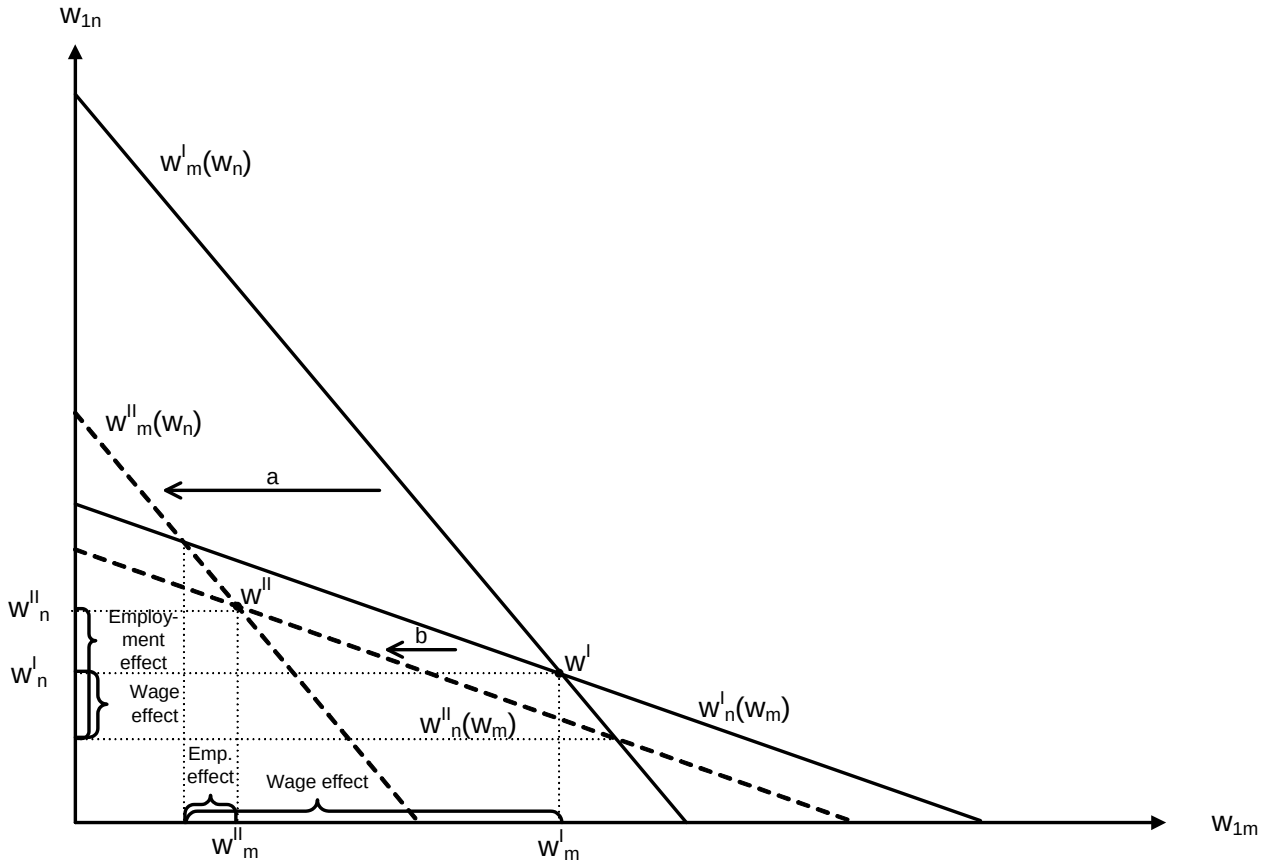
$$S_1 := -\underbrace{\frac{b}{U_{1m}}}_{>0}\underbrace{\frac{dU_{1m}}{dw_{1n}}}_{<0} > 0$$ ▸ Marginal

- w_{1n}^{I*} lies on the right hand side of w_{1n}^{II*}

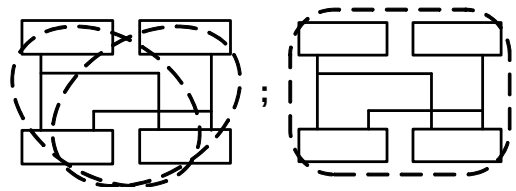
- with upward sloping *wage functions*: higher equilibrium wages $w_n^I \overset{!}{>} w_n^{II}$ ▸ Upward sloping
- but not necessarily with downward sloping *wage functions*!

Equilibrium wages

Shifts: $S_1 = -\frac{b}{U_{1m}} \frac{dU_{1m}}{dw_{1n}}$; $S_2 = -\frac{a}{U_{1n}} \frac{dU_{1n}}{dw_{1m}}$



Case 3 vs. Case 4



Case 3:

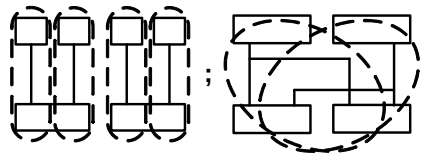
$$\frac{dN_n}{dw_{1n}} = \underbrace{\frac{a}{U_n}\frac{dU_n}{dw_{1n}}}_{\text{direct effect}} + \underbrace{\frac{c}{\pi_1}\frac{d\pi_1}{dw_{1n}} + \frac{c}{\pi_2}\frac{d\pi_2}{dw_{1n}}}_{\text{firm effect}} \stackrel{!}{=} 0$$

Case 4:

$$\frac{dN}{dw_{1n}} = \underbrace{\frac{a}{U_n}\frac{dU_n}{dw_{1n}}}_{\text{direct effect}} + \underbrace{\frac{b}{U_m}\frac{dU_m}{dw_{1n}}}_{\text{indirect effect}} + \underbrace{\frac{c}{\pi_1}\frac{d\pi_1}{dw_{1n}} + \frac{c}{\pi_2}\frac{d\pi_2}{dw_{1n}}}_{\text{firm effect}}$$

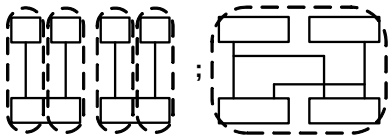
$S_3 := \frac{b}{U_m}\frac{dU_m}{dw_{1n}} < 0$ Similar to Case 1 vs. Case 2

Case 1 vs. Case 3



- Shift: $a\left(\frac{1}{U_n}\frac{dU_n}{dw_{1n}} - \frac{1}{U_{1n}}\frac{dU_{1n}}{dw_{1n}}\right) \overset{?}{\gtrless} 0$
- calculate equilibrium wages!
- for a wide parameter space: $w_{1n}^{III} > w_{1n}^{I}$
- low a, low c, and high b $w_{1n}^{I} > w_{1n}^{III}$

Case 1 vs. Case 4



$$S := \underbrace{a\left(\frac{1}{U_n}\frac{dU_n}{dw_{1n}} - \frac{1}{U_{1n}}\frac{dU_{1n}}{dw_{1n}}\right)}_{\text{sub. worker effect}} + \underbrace{b\left(\frac{1}{U_m}\frac{dU_m}{dw_{1n}}\right)}_{\text{comp. worker effect}} \lessgtr 0$$

- negative indirect effect on comp. workers: Only appears in Case IV and not under I : ceteris paribus lowers w^{IV} but not w^{I}. Depends on b.
- sub. worker effect positive: $1/U_n \cdot dU_n/dw_n$: ceteris paribus higher w^{IV} than w^{I}
- which effect predominates? Depends on a and b:
  - for $a = b$: $w^{IV} = w^{I}$
  - for $a > b$, sub. worker effect dominates and $w^{I} < w^{IV}$
  - for $b > a$, comp. worker effect dominates and $w^{IV} < w^{I}$

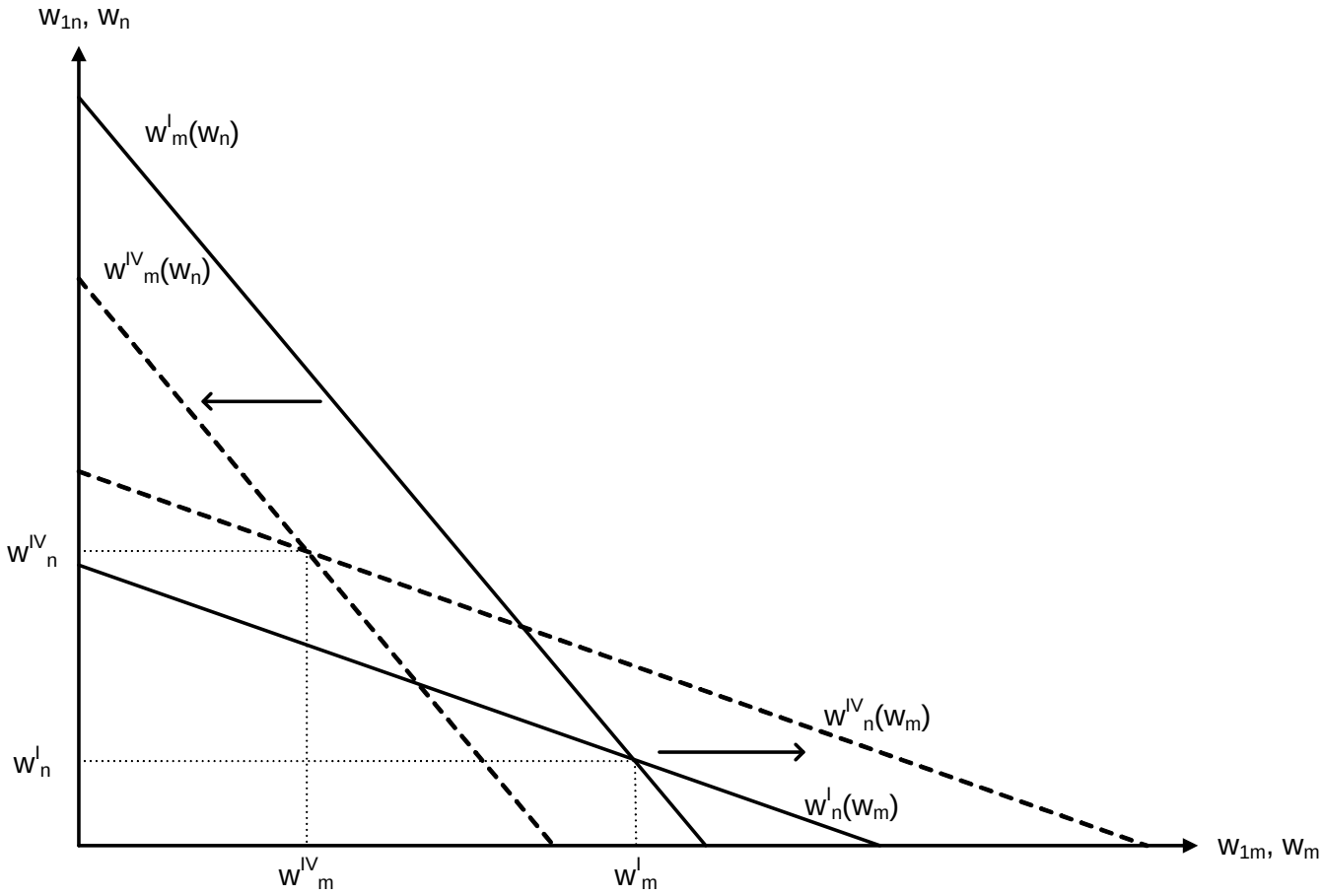
Case 1 vs. Case 4

- comparing Case 1 and Case 4 the *employment effect* due to asymmetric shifts of the *wage functions* of complementary workers does not matter:
- Shift w_{im}:

$$\underbrace{\frac{a}{U_n}\frac{dU_n}{dw_{1m}}}_{\text{comp. worker effect}} + \underbrace{b\left(\frac{1}{U_m}\frac{dU_m}{dw_{1m}} - \frac{1}{U_{1m}}\frac{dU_{1m}}{dw_{1m}}\right)}_{\text{sub. worker effect}} \lessgtr 0,$$

- they reinforce each other: A right shift for workers of type n results in a left shift for workers of type m and vice versa.

Case 1 vs. case 4

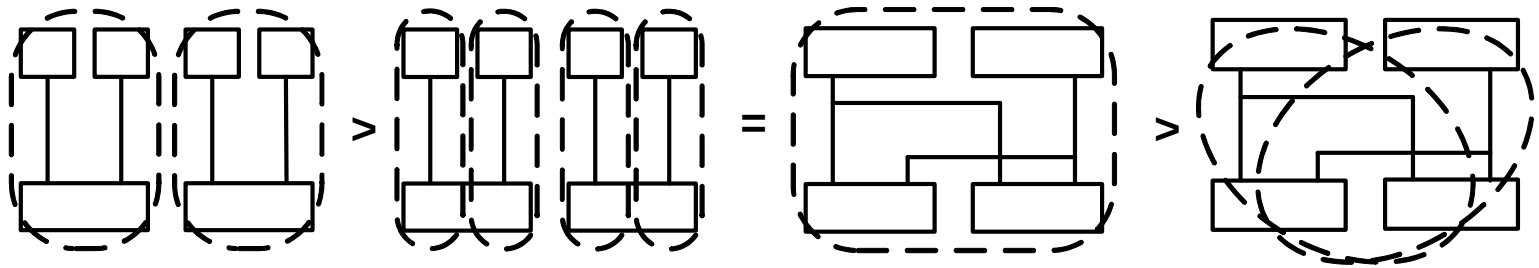


Unions

1. $U_j^{IV} > U_j^{II}$ for all $j = n, m$.
2. Comparing U_j^I and U_j^{II}, U_j^I and U_j^{III}, U_j^{III} and U_j^{IV},and U_j^{II} and $U_j^{III}$with $j = n, m$ depends on bargaining strengths a, b and c.
3. For $a > b$ $U_n^{IV} > U_n^I$ and $U_m^I > U_m^{IV}$, analog for $b > a$ $U_n^{IV} < U_n^I$ and $U_m^I < U_m^{IV}$, if $a = b$ $U_n^{IV} = U_n^I$.

Welfare

$$W = \frac{1}{2}(A - p)(x_1 + x_2) + \pi_1 + \pi_2 + U_{1n} + U_{2n} + U_{1m} + U_{2m}$$



$$W^{II} > W^{I} \geq W^{IV} > W^{III}$$

Conclusion

- no difference occurs between a *one union* or a *one negotiation framework*.
- no verification for:
  - Complementary workers: different unions
  - Substitutable workers: encompassing unions
- different union strengths: unambiguous results
  - different union utility functions
  - different union sizes

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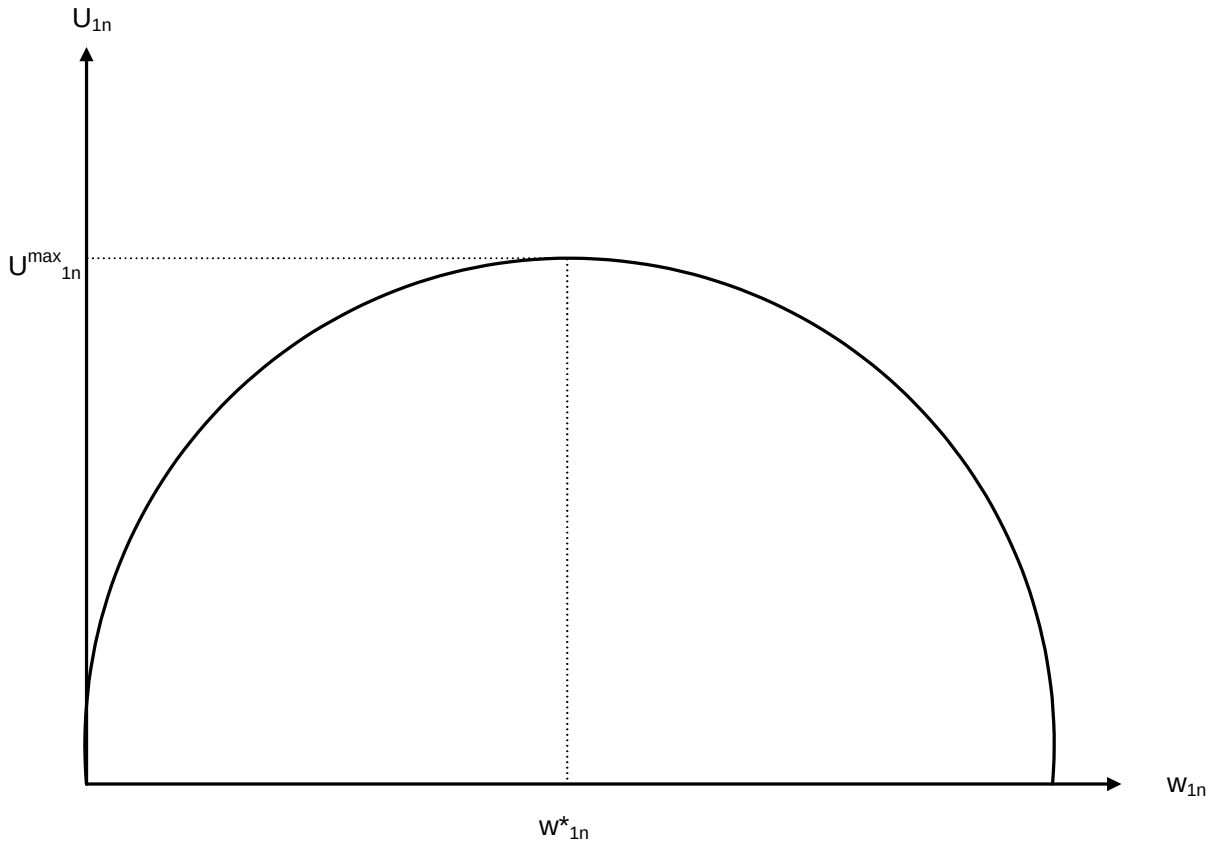

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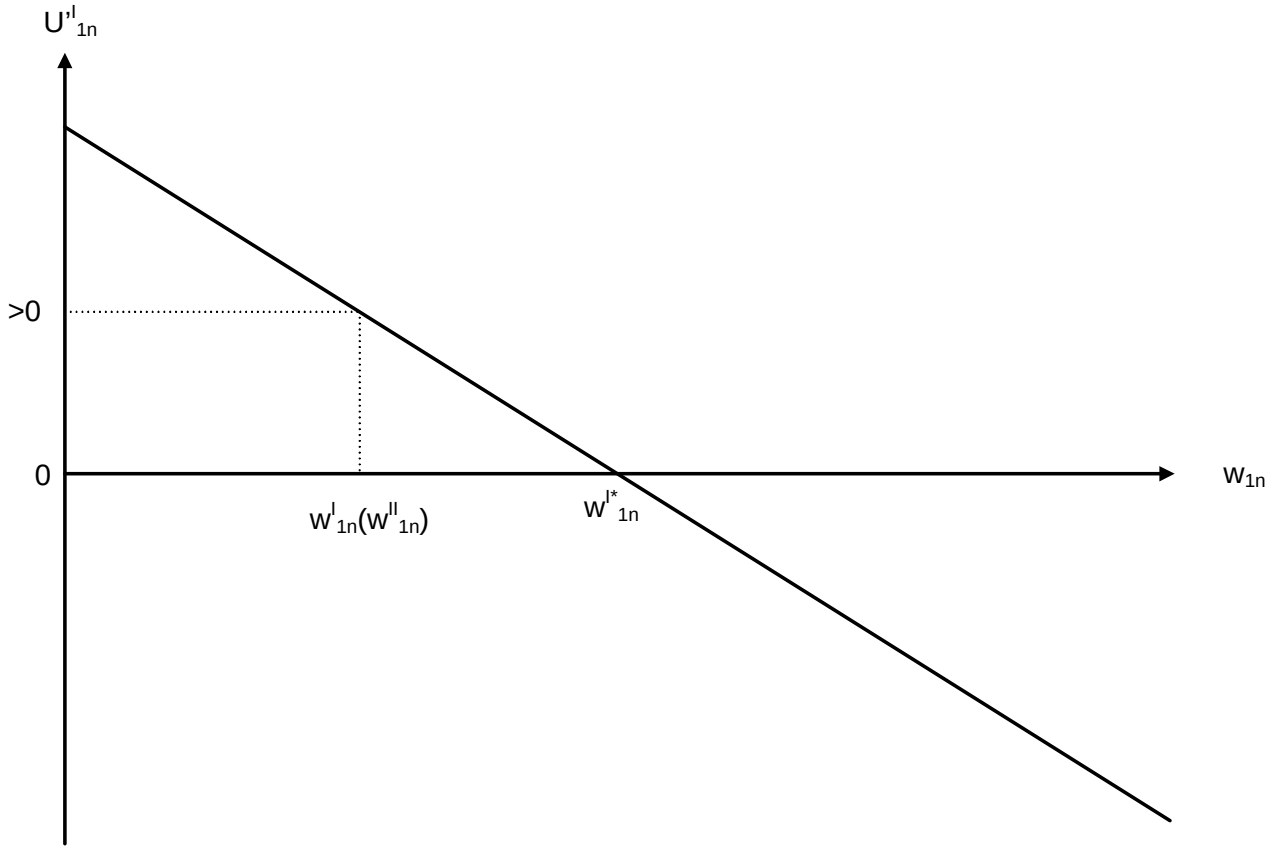

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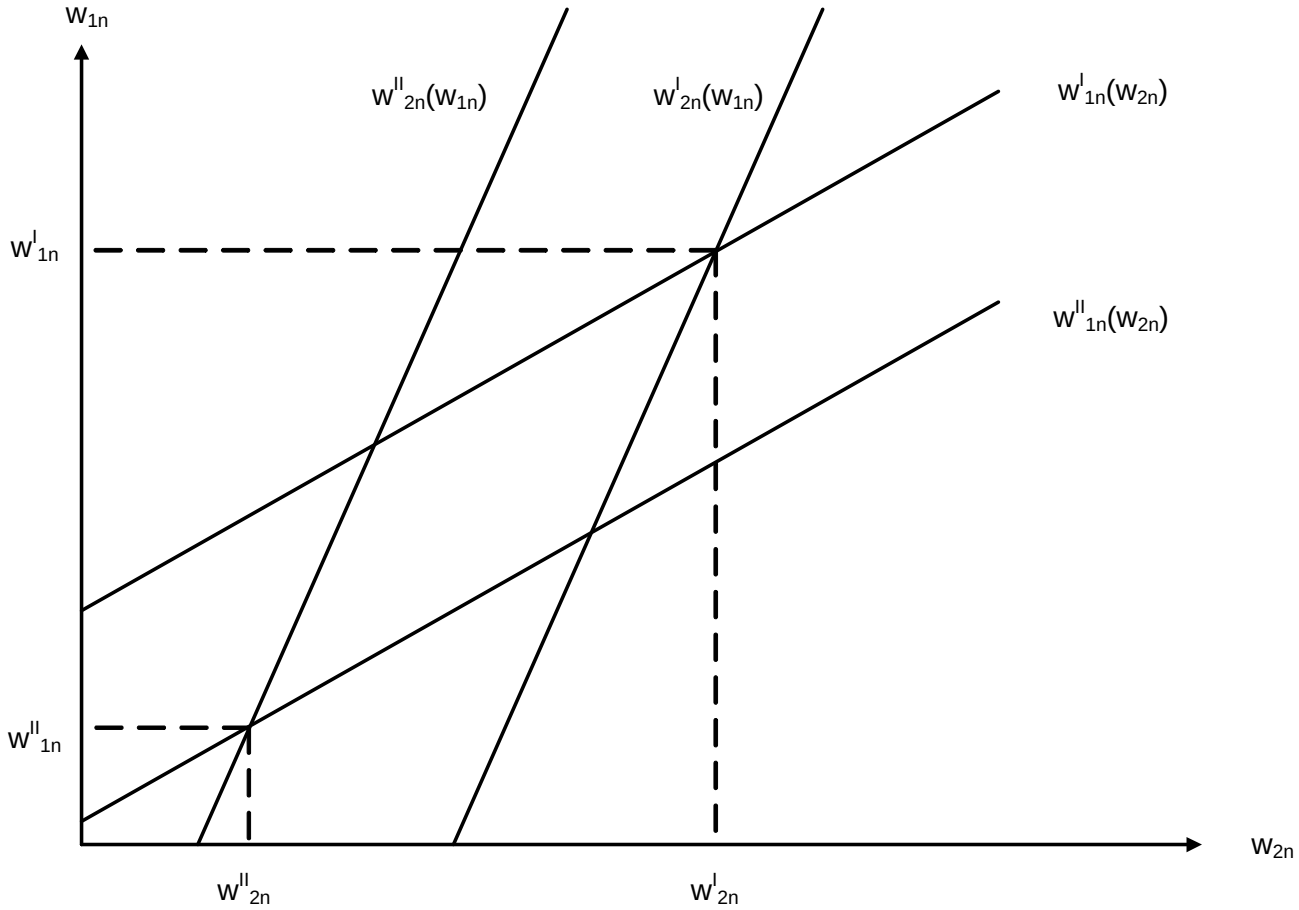
w_{1n}
$w^{II}_{2n}(w_{1n})$
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w^{I}_{1n}
$w^{II}_{1n}(w_{2n})$
w^{II}_{1n}
w_{2n}
w^{II}_{2n}
w^{I}_{2n}

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