Pattern Bargaining and Wage Leadership in a Small Open Economy

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Conventional wisdom - Scandinavian model of wage formation: under fixed exchange rates, international competition promotes wage restraint in the tradables sector, which spreads to the rest of the economy.

Pattern bargaining key feature of wage bargaining in many European countries. The tradables (manufacturing) sector typically acts as wage leader.

Especially service sector employers have started to question the wage leadership role of manufacturing.

- not due account of interests of service sector.
- the service sector is larger than manufacturing.

Monetary regime switches: no consensus on appropriate choice of wage leader under inflation targeting.
Issues

- How do macroeconomic outcomes depend on the choice of wage leader?
- How do the consequences of different choices of wage leadership differ between monetary regimes
  - flexible exchange rate and inflation targeting
  - fixed exchange rate (monetary union)
- How does the size of the wage leader affect outcomes?
- Why do subsequent wage bargains tend to mimic the leader's bargain?
- Or should one expect the leader’s bargain to set a floor for subsequent bargains?
Model set-up

- Wage leadership analysed as Stackelberg game.
  - comparisons with Nash game (uncoordinated bargaining).

- First part: standard trade union utility functions
  - trade unions try to maximise rents from unionisation.

- Second part: norm setting on the part of the leader
  - wage comparisons matter for utility of follower trade union.
  - Kahneman-Tversky loss aversion.
Main results

1. No (or very weak) support for the conventional wisdom that wage leadership for the tradables sector promotes wage moderation and employment

- under inflation targeting and standard union utility functions the choice of wage leader does not matter.
- under monetary union and standard union utility functions leadership for the non-tradables sector promotes employment.

2. Comparison thinking and loss aversion may promote employment

- if it causes the follower to mimic the wage of the leader.
- this can only happen if the smaller sector is wage leader and the follower is sufficiently loss averse.
Related literature

- **Liberal central banks promote wage restraint with inflation-averse trade unions in a closed economy**
  - Cukierman and Lippi (1999), Coricelli et al. (2006).

- **Conservative central banks promote wage restraint by deterring wage increases in a closed economy**

- **Comparisons of inflation targeting and monetary union in open economy**
The model

- A tradables and a non-tradables sector.
- Perfectly competitive firms in each sector.
- Given foreign-currency price of tradables from the world market.
- Domestic market clearing determines the price of non-tradables.
- Wage bargaining between one trade union and one employers’ association in each sector.
1. Wages are set.
2. Monetary policy (exchange rate) is determined.
3. Production, employment, consumption and prices are determined.

The model is solved through backward induction.
Stage 3: Individual choices and market clearing

Firms

Profit maximisation of firms

$$\max_{N_i} \Pi_i = \left( P_i Y_i - W_i N_i \right) / P$$

Production function

$$Y_i = \frac{1}{\theta_i} N_i^{\theta_i}$$

Sectoral employment function

$$N_i = \left( \frac{W_i}{P_i} \right)^{-\eta_i}$$,

where $\eta_i = (1 - \theta_i)^{-1} > 1$. 

Stage 3: Individual choices and market clearing cont.
Firms cont.

Supply function

\[ Y_i = \frac{1}{\theta_i} \left( \frac{W_i}{P_i} \right)^{-\sigma_i}, \]

where \( \sigma_i = \frac{\theta_i}{1 - \theta_i} \).

Profit function

\[ \Pi_i = \frac{1}{\eta_i - 1} \frac{W_i}{P} \left( \frac{W_i}{P_i} \right)^{-\eta_i} \]
Households spend all their income

$$\max_{C_N, C_T} C_N^\gamma C_T^{1-\gamma}$$

Goods demand functions

$$C_N = \gamma \frac{I}{P_N}$$

$$C_T = (1 - \gamma) \frac{I}{P_T}.$$
Market clearing for non-tradables, aggregate budget constraint and assumption of same production technology

\[ \frac{P_N}{P_T} = \left( \frac{\gamma}{1 - \gamma} \right)^{1-\theta} \left( \frac{W_N}{W_T} \right)^\theta \]

\( P_N/P_T \) is uniquely determined by \( W_N/W_T \).

Increase in \( W_N/W_T \) gives less than proportional increase in \( P_N/P_T \).
Stage 3: Individual choices and market clearing

Employment

Employment in each sector depends negatively on real consumption wages in both sectors

\[ N_N = w_N^{-\eta} \left( \frac{w_N}{w_T} \right)^{(1-\gamma)\sigma} \left( \frac{\gamma}{1-\gamma} \right)^{(1-\gamma)} \]

\[ N_T = w_T^{-\eta} \left( \frac{w_T}{w_N} \right)^{\gamma\sigma} \left( \frac{\gamma}{1-\gamma} \right)^{-\gamma} \]

\[ w_i = \frac{W_i}{P} \]

Aggregate employment

\[ \bar{N} = \left( \frac{w_N}{w_T} \right)^{(1-\gamma)\sigma} \left( \frac{\gamma}{1-\gamma} \right)^{(1-\gamma)} w_N^{-\eta} + \left( \frac{w_T}{w_N} \right)^{\gamma\sigma} \left( \frac{\gamma}{1-\gamma} \right)^{-\gamma} w_T^{-\eta} \]
Independent central bank sets the nominal exchange rate in order to attain the monetary target.

Inflation target: $d \ln P = 0$.

Monetary Union: $d \ln P_T = 0$.

Stage 1: Wage setting

The nominal wage in sector $i$, $W_{im}$, maximises

$$
[N_{im} \left( \frac{W_{im}}{P_m} - b \right)]^{\lambda_i} \left[ (\eta - 1)^{-1} \frac{W_{im}}{P_m} \left( \frac{W_{im}}{P_{im}} \right)^{-\eta} \right]^{(1-\lambda_i)}
$$

subject to

$$
N_{im} = \left( \frac{W_{im}}{P_{im}} \right)^{-\eta} \\
P_m = P(W_{im}, W_{jm}) \\
P_{im} = P_i(W_{im}, W_{jm}) \\
W_{jm} = f(W_{im}).
$$
Bargained wage

Real wage

\[ w_{im} = \frac{W_{im}}{P_m} = [1 + \lambda_i M_{im}] b, \]

The real consumption wage in a sector is a mark-up on the value of unemployment.

\[ M_{im} = \frac{\epsilon_{im}}{(\eta \varphi_{im} - \epsilon_{im})} \]
\[ \varphi_{im} = (1 - d \ln P_i / d \ln W_i)_m \]
\[ \epsilon_{im} = (1 - d \ln P / d \ln W_i)_m \]

\( d \ln P_i / d \ln W_i \) and \( d \ln P / d \ln W_i \) differ depending on monetary regime and what sector is wage leader.
The monetary regime and wage leadership

\[ d \ln P = \gamma d \ln P_N + (1 - \gamma) d \ln P_T. \]
\[ d \ln P_N - d \ln P_T = \theta (d \ln W_N - d \ln W_T). \]

Inflation targeting: \( d \ln P = 0. \)
Monetary union: \( d \ln P_T = 0. \)

Stackelberg leader \( i \) also takes into account that \( f' > 0 \) in \( W_{jm} = f(W_{im}). \)
In Nash equilibrium and for follower \( j \) \( f' = 0. \)
Regime-specific mark-ups under different bargaining set-ups

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<th>Leader</th>
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• Under inflation targeting, the Nash equilibrium coincides with the two Stackelberg equilibria, since \( M_{ij}^{Nash} = M_{ij}^N = M_{ij}^T \) for \( i = N, T \).

• So, it does not matter what sector is wage leader under pattern bargaining and pattern bargaining always gives the same outcome as uncoordinated bargaining.

• Leader takes into account that

\[
\frac{d \ln W_j}{d \ln W_i} = \frac{d \ln P}{d \ln W_i},
\]

but since \( d \ln P = 0 \) under inflation targeting, the leader solves the same optimisation problem as the follower (and as in the Nash game).
In a monetary union, the real consumption wage in a sector is the same when the sector is wage follower in a Stackelberg game as in a Nash game, since $M^j_{i M} = M^{Nash}_{i M}$ for $i, j = N, T, i \neq j$.

The follower in a Stackelberg game solves the same optimisation problem as it would in a Nash game.

In a monetary union, the real consumption wage in the non-tradables sector is lower in the Stackelberg game when the sector is wage leader than in the Nash game, as $M^{Nash, T}_{NM} > M^N_{NM}$.

The Stackelberg game with the non-tradables sector as wage leader results in higher employment in both sectors than in the Nash game.

The real consumption wage in the tradables sector is higher in the Stackelberg game when the sector is leader than in the Nash game, as $M^{T}_{TM} > M^{Nash, N}_{TM}$.

The Stackelberg game with the tradables sector as leader results in lower employment in both sectors than in the Nash game.

These conclusions go against the conventional wisdom.
Intuition for higher wage in the tradables sector when it is leader

- A wage increase in the tradables sector reduces output there.
- As a consequence demand for non-tradables, the price of non-tradables and the CPI fall.
- The CPI fall strengthens the incentive to raise wages in the tradables sector.

- The CPI fall causes the wage in the non-tradables sector to fall.
- This reduces the CPI even more and strengthens the incentive to raise the wage in the tradables sector.
Intuition for lower wage in the non-tradables sector when it is leader

- A wage increase in the non-tradables sector raises the price of non-tradables and the CPI.
- The CPI rise causes the wage in the tradables sector to rise.
- As a consequence demand for non-tradables falls, which tends to offset the rise in the price of non-tradables.
- The smaller rise in the price of non-tradables means a larger fall in employment in the non-tradables sector.
- This reduces the incentive to raise the wage in the non-tradables sector.
Table 7: Equilibrium outcomes without wage norms, $\lambda_N = \lambda_T = .5$

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Following Holden and Wulfsberg (2007), the perceived utility of an employed worker in sector \( i \) is given by:

\[
\tilde{w}_i = \frac{w_i^{1+\alpha_k}}{w_n^{\alpha_k}} = \frac{W_i^{1+\alpha_k}}{W_n^{\alpha_k}} P
\]

where

\[
\alpha_k = \begin{cases} 
\alpha_1 & \text{when } w_i \leq w_n, \\
0 & \text{when } w_i > w_n
\end{cases}
\]

The marginal utility of a wage increase is higher immediately below the wage norm than immediately above

\[
\frac{\partial \tilde{w}_i}{\partial w_i} = (1 + \alpha_k) \left( \frac{w_i}{w_n} \right)^{\alpha_k}.
\]
Figure 1: Union-perceived marginal utility of the real wage for an employed worker (N.B. The diagram is drawn under the assumption that $0 < \alpha_1 < 1$.
The leader’s wage is assumed to be the wage norm. The trade union utility function thus looks the same as before in the leader sector $i$:

$$\tilde{w}_i = w_i^{1+\alpha_k} / w_n^{\alpha_k} = w_i^{1+\alpha_k} / w_i^{\alpha_k} = w_i$$

For the follower $j$ there could be:

1. A corner solution with $w_j = w_i$
2. An interior solution with $w_j \neq w_i$

Corner solution requires

$$\lim_{w_{jm} \to w_{im}} \lambda_j \left[ -\eta \varphi_{jm} + \frac{\tilde{w}_{jm}(\alpha_1+\epsilon_{jm})}{(\tilde{w}_{jm}-b)} \right] + (1 - \lambda_j) \left[ \epsilon_{jm} - \eta \varphi_{jm} \right] > 0$$

$$\lim_{w_{jm} \to w_{im}^+} \lambda_j \left[ -\eta \varphi_{jm} + \frac{\tilde{w}_{jm}(\alpha_2+\epsilon_{jm})}{(\tilde{w}_{jm}-b)} \right] + (1 - \lambda_j) \left[ \epsilon_{jm} - \eta \varphi_{jm} \right] < 0.$$
Interior solution for the follower

Utility of an employed worker is still a mark-up on the value of unemployment

\[ \tilde{w}_{jm} = \left[ 1 + \lambda_j \tilde{M}_{jm} \right] b, \]

where

\[ \tilde{M}_{jm} = \left( \alpha_k + \epsilon_{jm} \right) / \left( \eta \varphi_{jm} - \epsilon_{jm} - \lambda_j \alpha_k \right). \]

Follower’s wage:

\[ w_{jm} = \left[ 1 + \lambda_j \tilde{M}_{jm} \right] \frac{1}{1 + \alpha_k} \ b^{1 + \alpha_k} \ \frac{\alpha_k}{1 + \alpha_k} \ \omega_{im}. \]

Wage response of follower:

\[ \frac{d \ln W_{jm}}{d \ln W_{im}} = \frac{\alpha_k}{1 + \alpha_k} + \frac{1}{1 + \alpha_k} \ \frac{d \ln P}{d \ln W_{im}}. \]

The follower’s wage may be higher or lower than the norm depending on parameters.
\[
\begin{align*}
M_{NI} &= \frac{(1-\theta)(1+\alpha_k)}{\theta(\alpha_k+\gamma)} \\
\tilde{M}_{TI} &= \frac{(1+\alpha_k)(1-\theta)}{(1-\gamma \theta)-(1+\lambda_T \alpha_k)(1-\theta)} \\
M_{TI} &= \frac{(1-\theta)(1+\alpha_k)}{\theta(\alpha_k+1-\gamma)} \\
\tilde{M}_{NI} &= \frac{(1+\alpha_k)(1-\theta)}{(1-(1-\gamma \theta)-(1+\lambda_N \alpha_k)(1-\theta)} \\
M_{NM} &= \frac{(1-\theta)(1+\alpha_k)}{\theta(\alpha_k+\gamma)} \\
\tilde{M}_{TM} &= \frac{(1+\alpha_k+\gamma \theta)(1-\theta)}{\theta(1-\gamma+\gamma \theta)-\lambda_T \alpha_k(1-\theta)} \\
M_{TM} &= \frac{(1-\theta)(1+\alpha_k)}{\theta(\alpha_k+1-\gamma)} \\
\tilde{M}_{NM} &= \frac{1+\alpha_k-\gamma \theta}{\gamma \theta-\lambda_N \alpha_k}
\end{align*}
\]
Vartiainen (2007): bargaining system where the follower’s wage mimics the leader’s wage is conducive to high employment and welfare.

When the leader knows that the follower will set the same wage, the incentives for wage restraint are strong.

Here there is a set of possible corner solutions.

Lower bound for corner solution \((w_i = w_j \equiv w^l)\) defined by
\[
\left( \frac{\partial \ln \Omega_j}{\partial \ln w_j} \right)_- = 0 \quad \text{while} \quad \left( \frac{\partial \ln \Omega_j}{\partial \ln w_j} \right)_+ < 0.
\]

Upper bound for corner solution \((w_i = w_j \equiv w^u)\) defined by
\[
\left( \frac{\partial \ln \Omega_j}{\partial \ln w_j} \right)_+ = 0 \quad \text{while} \quad \left( \frac{\partial \ln \Omega_j}{\partial \ln w_j} \right)_- > 0.
\]
Figure 2: The set of possible corner solutions
Macroeconomic outcomes of choice of wage leader

- Due to the discontinuous objective function of the follower standard optimisation techniques are insufficient.
- Leader may set wage strategically to achieve the equilibrium that gives it the highest utility.
- Numerical solutions needed to determine type of equilibrium.
- What is the impact of relative sector size?
- Do wage setters in the two sectors agree on the choice of leader?
- How does the degree of loss aversion affect the type of equilibrium?
Table 8: Equilibrium outcomes with wage norms and a high degree of loss aversion ($\lambda_N = \lambda_T = .5$ and $\alpha_1 = .3$)

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Results I: Strong loss aversion

- $\alpha_1 = .3$

- With strong loss aversion two types of equilibria occur: corner solutions for the follower and interior solutions where $w_j > w_i$.

- Regardless of monetary regime, corner solutions are likely to arise when leadership is assigned to the smaller sector.

- Aggregate employment (but not necessarily welfare) much higher for corner solutions than interior solutions.

- Leadership for the smaller sector is thus likely to promote employment.

- Under inflation targeting, both sectors would prefer to be wage follower.

- In a monetary union, both sectors are better off if the $N$-sector is wage leader.
Table 9: Equilibrium outcomes with wage norms and a low degree of loss aversion ($\lambda_N = \lambda_T = .5$ and $\alpha_1 = .03$)

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<td>$w_j &gt; w_i$</td>
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Results II: Weak loss aversion

- $\alpha_1 = .03$
- With weak loss aversion corner solutions are less likely.
- If the $T$-sector is small ($\gamma = .75$) and wage leader, a corner solution arises.
- When there are interior solutions, the wage of the follower may be higher or lower than the norm depending on sector size.
- Under inflation targeting, leadership for the larger sector promotes employment.
Table 10: Equilibrium outcomes with wage norms, larger bargaining power for employers in the tradables than in the non-tradables sector and a high degree of loss aversion ($\lambda_N = .9$, $\lambda_T = .1$ and $\alpha_1 = .3$)

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<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>$w_N$</td>
<td>1.532</td>
<td>1.279</td>
</tr>
<tr>
<td>$w_T$</td>
<td>1.140</td>
<td>1.166</td>
</tr>
<tr>
<td>$N_N$</td>
<td>.126</td>
<td>.422</td>
</tr>
<tr>
<td>$N_T$</td>
<td>.508</td>
<td>.154</td>
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<tr>
<td>$N$</td>
<td>.634</td>
<td>.576</td>
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<tr>
<td>$\Omega_N$</td>
<td>.065</td>
<td>.119</td>
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<tr>
<td>$\Omega_T$</td>
<td>.120</td>
<td>.042</td>
</tr>
<tr>
<td>Type of equilibrium</td>
<td>$w_j &lt; w_i$</td>
<td>$w_j &lt; w_i$</td>
</tr>
</tbody>
</table>
Results III: Lower bargaining power for unions in the tradables sector

- Often argued that employers are relatively stronger in the tradables sector as they may move production abroad etc.
- Account for this possibility by setting $\lambda_T = .1$ and $\lambda_N = .9$.
- Under this parameterisation, leadership for the tradables sector promotes employment.
- Intuition: weak unions imply wage restraint in the tradables sector thereby holding back wages also in the follower sector.
- Weak case for why wage leadership for the tradables sector might promote employment.
- It is not obvious that unions are relatively weaker in the tradables sector than in the non-tradables sector as unionisation is greater in the tradables sector.
Conclusions

- Analysis of wage leadership is more complex than one might think.
- Difficult to build case that leadership for tradables sector promotes employment.
- Under inflation targeting and standard union utility functions it does not matter who is wage leader.
- Under monetary union, leadership for tradables sector gives lower employment than leadership for non-tradables sector.
- Wage comparisons and loss aversion may promote employment.
- If loss aversion is sufficiently high employment-promoting corner solutions can be achieved by assigning leadership to the smaller sector.
What is wrong with the real world?

- Or does the model miss something?
- More centralisation within tradables sector than within non-tradables sector? Yes.
- Public sector instead of private, profit-maximising non-tradables firms? Possibly.
- Easier to make correct assessments about productivity growth in tradables sector? Yes.