

Pattern Bargaining, Wage Leadership and Inflation Targeting

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Background

- Conventional wisdom: international competition promotes wage restraint in the tradables sector, which spreads to the rest of the economy
- Pattern bargaining is key feature of wage bargaining in many European countries
- The tradables (manufacturing) sector acts as wage leader
- The non-tradables (services) sector has begun to challenge the wage leadership of the tradables (manufacturing) sector

The case of Sweden

- EFO (Nordic) model of wage formation: room for wage increases defined by tradables sector under fixed exchange rate
- Same principle in the Industry Agreement and in the instruction of the National Mediation Office
- 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

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 expected income of representative member
- 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. Leadership for the larger sector promotes employment under inflation targeting

- it is size, not the type of sector, that matters

3. 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
- possible argument for leadership for the tradables sector

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

- Soskice and Iversen (2000), Coricelli et al. (2006), Larsson (2007)

Comparisons of inflation targeting and monetary union in open economy

- Vartiainen (2002, 2008), Holden (2003), Larsson (2007)

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

Timing

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

Firms

Profit maximisation of firms

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

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

Supply function

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

where $\sigma_i = \theta_i / (1 - \theta_i)$.

Profit function

$$\Pi_i = \frac{1}{\eta_i - 1} \frac{W_i}{P} \left(\frac{W_i}{P_i} \right)^{-\eta_i}$$

Households

Households spend all their income

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

Goods demand functions

$$C_N = \gamma \frac{I}{P_N}$$
$$C_T = (1 - \gamma) \frac{I}{P_T}.$$

CPI

$$P = P_N^\gamma P_T^{1-\gamma},$$

where γ is the budget share of non-tradables.

Market clearing

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 .

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

$$\bar{N} = \left(\frac{w_N}{w_T} \right)^{(1-\gamma)\sigma} \left(\frac{\gamma}{1-\gamma} \right)^{(1-\gamma)} w_N^{-\eta} + \left(\frac{w_T}{w_N} \right)^{\gamma\sigma} \left(\frac{\gamma}{1-\gamma} \right)^{-\gamma} w_T^{-\eta}$$

Wage setting

Trade union utility

$$V_i = \frac{N_i}{L_i} w_i + \left(1 - \frac{N_i}{L_i}\right) b.$$

Nash bargaining product

$$\Omega_{im} = \left[\frac{N_{im}}{L_i} (w_{im} - b) \right]^{\lambda_i} [\Pi_{im}]^{1-\lambda_i},$$

where subscript m denotes monetary regime.

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

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

Constraints

$$\begin{aligned} N_{im} &= \left(\frac{W_{im}}{P_{im}} \right)^{-\eta} \\ P_m &= P(W_{im}, W_{jm}) \\ P_{im} &= P_i(W_{im}, W_{jm}) \\ W_{jm} &= f(W_{im}) \end{aligned}$$

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.

$$\begin{aligned} M_{im} &= \epsilon_{im} / (\eta \varphi_{im} - \epsilon_{im}) \\ \varphi_{im} &= (1 - d \ln P_i / d \ln W_i)_m \\ \epsilon_{im} &= (1 - d \ln P / d \ln W_i)_m \end{aligned}$$

$d \ln P_i / d \ln W_i$ 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 $f' = 0$.

Same relative bargaining strength λ in both sectors.

	(1)	(2)	(3)
Leader	<i>Nash</i>	<i>N</i>	<i>T</i>

M_{NI}	$\frac{1-\theta}{\gamma\theta}$	$\frac{1-\theta}{\gamma\theta}$	$\frac{1-\theta}{\gamma\theta}$
M_{TI}	$\frac{1-\theta}{(1-\gamma)\theta}$	$\frac{1-\theta}{(1-\gamma)\theta}$	$\frac{1-\theta}{(1-\gamma)\theta}$
M_{NM}	$\frac{1-\gamma\theta}{\gamma\theta}$	$\frac{1-\theta}{\gamma\theta}$	$\frac{1-\gamma\theta}{\gamma\theta}$
M_{TM}	$\frac{(1+\gamma\theta)(1-\theta)}{\theta(1-\gamma+\gamma\theta)}$	$\frac{(1+\gamma\theta)(1-\theta)}{\theta(1-\gamma+\gamma\theta)}$	$\frac{1-\theta}{(1-\gamma)\theta}$

- Under inflation targeting, the Nash equilibrium coincides with the two Stackelberg equilibria, since $M_{iI}^{Nash} = M_{iI}^N = M_{iI}^T$ 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 $M_{iM}^j = M_{iM}^{Nash}$ 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 $M_{NM}^{Nash, T} > M_{NM}^N$.
- 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 $M_{TM}^T > M_{TM}^{Nash,N}$.
- 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.
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- 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.
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- 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.

Comparison norm and loss aversion

Trade union utility

$$V_i = \frac{N_i}{L_i} \tilde{w}_i + \left(1 - \frac{N_i}{L_i}\right) b.$$

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

$$\alpha_k = \begin{cases} \alpha_1 & \text{when } w_i \leq w_n, \\ \alpha_2 & \text{when } w_i > w_n, \text{ where } \alpha_1 > \alpha_2 \end{cases}$$

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

$$\frac{\partial \tilde{w}_i}{\partial w_i} = (1 + \alpha_k) \left(\frac{w_i}{w_n}\right)^{\alpha_k}.$$

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

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

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

Corner solution for the follower

Leader takes into account that $d \ln W_j / d \ln W_i = 1$.

Wage outcomes will be the same independent of monetary regime and which sector is wage leader, as $M_{NI}^N = M_{NM}^N = M_{TI}^T = M_{TM}^T = (1 - \theta) / \theta$.

$$d \ln P = \gamma d \ln P_N + (1 - \gamma) d \ln P_T.$$

$$d \ln P_N - d \ln P_T = \theta (d \ln W_N - d \ln W_T).$$

$$d \ln W_N = d \ln W_T \Rightarrow d \ln P_N = d \ln P_T.$$

Hence, no price can change under neither inflation targeting ($d \ln P = 0$) nor monetary union ($d \ln P_T = 0$).

Interior solution for the follower

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

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

where

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

The wage is a weighted geometric average of the value of unemployment and the leader's wage

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

Wage response of follower

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

Different solutions under inflation targeting

Let s = the budget share in consumption of the leader

We can define a critical value

$$\bar{\alpha} \equiv \frac{1 - 2s}{1 + \lambda \frac{(1-\theta)}{\theta}}$$

If $\alpha_2 < \alpha_1 < \bar{\alpha}$ we have an interior solution with a lower wage for the follower than the leader.

If $\alpha_1 > \alpha_2 > \bar{\alpha}$ we have an interior solution with a higher wage for the follower than the leader.

$\alpha_1 > \bar{\alpha} > \alpha_2$ we have a corner solution with the same wage for the follower and the leader.

If $s \geq 1/2$ (larger leader sector) we always have an interior solution with a higher wage for the follower.

If $s \leq 1/2$ (smaller leader sector) we **could** have a corner solution with equal wages or an interior solution with a lower wage for the follower.

Leader	N	T
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}		$\frac{1+\alpha_k-\gamma\theta}{\gamma\theta-\lambda_N\alpha_k}$

Macroeconomic outcomes of choice of wage leader under inflation targeting

- A large leader will set a lower wage than a small leader.
- Theoretically unclear if a small follower will set a higher or lower wage than a large follower.
 - a small follower tends to set a high wage if no wage comparisons (smaller effect on central bank policy).
 - but a lower wage norm if leader is large.
- Numerical examples suggest that small follower sets higher wage.
- But aggregate employment seems to be higher with large leader.

	<i>Nash</i>		<i>No norm</i>		<i>Norm</i>			<i>Norm</i>	
Leader	<i>N</i>	<i>T</i>	<i>N</i>	<i>N</i>	<i>N</i>	<i>T</i>	<i>T</i>	<i>T</i>	
$\bar{\alpha}$.44	.44	.44	.44	.44	.44	
α_1			.34	.54	.64	.34	.54	.64	
α_2			.24	.34	.54	.24	.34	.54	
w_{NI}	1.50	1.50	1.50	1.28	1.13	1.24	1.58	1.61	1.68
w_{TI}	1.17	1.17	1.17	1.25	1.13	1.27	1.16	1.15	1.15
N_{NI}	.12	.12	.12	.14	.24	.14	.11	.11	.10
N_{TI}	.47	.47	.47	.42	.73	.41	.47	.46	.45
N_I	.60	.60	.5964	.56	.98	.55	.58	.57	.55
Follower				Interior	Corner	Interior	Interior	Interior	Interior

Wage comparisons can promote employment under inflation targeting

- Corner solutions with strong loss aversion
 - both leader and follower wage then lower than without wage comparisons
 - strong wage response of follower disciplines leader
 - hence aggregate employment is higher
 - according to the simulations it is much higher
- Interior solutions
 - somewhat lower aggregate employment with wage comparisons than without.

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.
- Under some assumptions wage leadership for the larger sector raises employment under inflation targeting, under others it reduces employment.
- Wage comparisons and loss aversion may promote employment.

What is wrong with the real world?

- Or does the model miss something?
- Stronger bargaining power of employers in tradables sector? Probably.
- Higher labour demand elasticities in tradables sector? Not likely.
- More centralisation within tradables sector than within non-tradables sector? Yes.
- More rational considerations in tradables than in non-tradables sector? Probably.