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A Two-Sector Effort-Regulation Model with Implications for Wage Developments of the 1980s

William D. Ferguson

INTRODUCTION

Economic events of the 1980s reveal declining real wages for non-supervisory workers in goods sector industries accompanied by lesser declines in service sector industries. A simple two-sector effort-regulation model — which assumes that the cost of job loss responds to labor's bargaining power and which acknowledges influences of institutional change, import penetration and shifting employment — can account for these developments as well as the simultaneous decrease of unemployment and real wages in the late 1980s.

THE MODEL

Assume two sectors, a "goods" sector (g) and a "service" sector (c) where the former pays higher wages.¹ Both sectors operate in an "efficiency-wage" setting; they observe microeconomic wage-setting principles presented in Bowles (1985), Bulow and Summers (1986) and Shapiro and Stiglitz (1984). Here efficiency wages result from the combination of utility maximization on the part of workers and profit maximization on the part of firms, given the unspecified nature of the labor contract and in particular the unspecifiable nature of workers' effort per hour of labor. For the present analysis one key result emerges: in order to maximize profits, via a tradeoff between wages and effort, firms must set wages high enough so that workers will face a positive cost of job loss (COJL) if dismissed for disciplinary reasons. As a result, both sectors set wages so that the COJL for employed workers is greater than zero.²

Now add four assumptions:

- i) Laid-off workers earn only an hourly unemployment benefit which is set exogenously for each industry by the state.³

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ii) The unemployment benefit for former goods workers (u_g) is greater than the benefit for former service workers (u_c), and both levels of unemployment insurance are below wage levels for the industry concerned.

iii) Firms set wages to make the COJL in the goods sector higher than the COJL in the service sector ($w_g \sim > w_c \sim$).

iv) The COJL in each sector ($w_c \sim$ and $w_g \sim$) has endogenous and exogenous components:

a. The endogenous component responds to reemployment probabilities (the j 's below);

b. The exogenous component responds to exogenous changes in social, cultural, political and technological conditions, notably labor's bargaining power.

Assumptions i and ii imply the following definitions for each industry's job loss per hour:

$$w_c \sim = w_c - j_{cc}w_c - j_{cg}w_g - (1-j_c)u_c \quad (1)$$

$$w_g \sim = w_g - j_{gc}w_c - j_{gg}w_g - (1-j_g)u_g \quad (2)$$

where: $w_c \sim$ and $w_g \sim$ represent the COJL for the service and goods sectors, respectively; j_{ij} shows the probability of an unemployed worker in sector i finding a job in sector j , and j_i shows the aggregate probability of an unemployed worker in sector i finding a job in either sector.

These equations indicate that for given real wage levels, an exogenous increase in unemployment, which reduces the j 's, will increase both $w_c \sim$ and $w_g \sim$. This is the endogenous component of the cost of job loss under iv) a.

The third assumption rests on two justifications. First, since the goods sector is, relatively speaking, the capital-intensive sector with a higher rate of labor productivity, goods sector firms face higher losses if workers do not provide profit-maximizing levels of effort; in effect the goods sector has a higher elasticity of productivity with respect to effort than the service sector. Secondly, since the goods sector has a higher level of unionization, firms experience more difficulty in dismissing workers for disciplinary reasons, hence the probability of dismissal for providing less than requisite effort is less for goods workers than for service workers.⁴ Goods industries therefore achieve, via high wages, a high enough COJL to compensate for low probabilities of disciplinary dismissal as well as high effort elasticity of productivity.

Assumption iv) a. is a straightforward application of effort regulation logic, as is the technological component of iv) b. The social/bargaining component of iv) b. offers a new element in this analysis: for given levels of unemployment and given technology, the existing cost of job loss is assumed to reflect labor's bargaining power. In particular when labor is strong, firms must pay a higher wage yielding a higher COJL to induce a given level of effort than when labor is weak.⁵

Solving equations 1 and 2 for sector wages:

$$wc = [wc \sim + j_{cg}wg + (1-j_c)uc]/(1-j_{cc}) \quad (3)$$

$$wg = [wg \sim + j_{gc}wc + (1-j_g)ug]/(1-j_{gg}) \quad (4)$$

In order to interpret these equations, it is necessary to specify the reemployment probabilities, the j terms. These in turn clarify the relationship between employment levels and wages. There are clearly numerous ways this could be done. Analysis will proceed with a few simple assumptions. Assume:

v) The probability of finding work in the goods sector for laid-off service workers is a constant non-negative proportion (less than one) of the probability of former goods workers finding reemployment in the goods sector. Former workers from both sectors, however, have equal chances of gaining employment in services.

As a result:

$$j_{cg} = mj_{gg}, \quad 0 < m < 1; \quad \text{and} \quad j_{cc} = j_{gc} \quad (5)$$

Applying these conditions to equations 3 and 4 and solving for the wage difference $wg - wc$:

$$wg - wc = wg \sim - wc \sim + (1-m)j_{gg}wg + (1-j_g)ug - (1-j_c)uc \quad (6)$$

Given the assumptions on the exogenous terms and m , this solution is positive; the model thus reflects the stylized fact that in industrial economies goods industries pay higher average wages than service sector industries.

Returning to the j 's, assume further that the reemployment probabilities are proportional to the employment ratios in each sector, reflecting aggregate demand for employment in each sector:

vi) The probability of a dismissed worker obtaining employment in either sector is proportional to the ratio of that sector's employment to the labor force.

Combining v and v_i :

$$j_{cc} = j_{gc} = \alpha Nc/L \quad (7)$$

$$j_{gg} = \lambda Ng/L \quad \text{and} \quad j_{cg} = m\lambda Ng/L \quad (8)$$

$$j_g = \alpha Nc/L + \lambda Ng/L = \delta N/L \quad \text{and} \quad j_c = \delta(Nc + mNg)/L \quad (9)$$

Where: α , λ and δ are parameters, > 0 .

Placing these specifications of the j terms into equations 3 and 4:

$$wc = \frac{wc\sim + (m\lambda Ng/L)wg + (1 - \delta(Nc+mNg)/L)uc}{1 - (\alpha Nc/L)} \quad (3')$$

$$wg = \frac{wg\sim + (\alpha Nc/L)wc + [1 - (\delta N/L)]ug}{1 - (\lambda Ng/L)} \quad (4')$$

Four notable results follow from these equations (*ceteris paribus*):

i) An increase in unemployment (a reduction in the ratio $(Nc + Ng)/L$) causes endogenous responses in wages and COJL in opposite directions. Specifically it:

a. reduces wages in both sectors, and

b. increases the endogenous component of each sector's COJL (from equations 1 and 2).

ii) An increase in each sector's employment share (i.e., an increase in its own level of employment holding unemployment constant) increases its own wage.⁶

iii) An increase in the unemployment benefit for each sector increases its own wage.

iv) An exogenous increase in the COJL for each sector increases its own wage.

These results are not surprising. Result i) a. parallels conventional supply-and-demand analysis as does result ii) if one assumes labor is homogenous prior to employment.⁷ The employment share result suggests

unambiguously that industrial shift — the shift of employment away from goods and toward services — reduces the wage differential between the sectors (*ceteris paribus*). Result iii) is an obvious result of an effort-regulation framework, as is result iv) given an exogenous component to the COJL. Further analysis expands the implications of this last result.

Two final assumptions facilitate application of the model to wage developments of the 1980s:

vii) A key determinate of the exogenous component of the COJL is labor's bargaining power in each sector.⁸

viii) Bargaining power is influenced by the following factors: the percentage of union coverage in each sector, the elasticity of demand for domestic labor in each sector and the institutional legal setting including the status of labor law. Reductions in union coverage, increases in labor demand elasticity and adverse institutional changes all reduce labor's bargaining power.⁹

Reduced bargaining power in turn lowers the COJL and thus wages in this model for a given level of unemployment. These bargaining effects are likely to be more pronounced in the goods sector, where union coverage is more complete.

THE 1980S

During the 1980s the following relevant developments occurred: i) an adverse shift in the institutional setting from labor's point of view exemplified by the Reagan National Labor Relations Board, the breaking of the air traffic controllers' strike and increased employer willingness to confront unions (Edwards and Podgursky 1986); ii) declining union coverage nationally and particularly in mining and manufacturing; iii) a dramatic increase in import penetration, predominantly in the manufacturing sector, and iv) a decline in both relative and absolute employment for the goods sector and manufacturing in particular.¹⁰

The first three of these developments unambiguously reduce labor's bargaining power as conceived above; moreover they affect the goods sector far more than the service sector.¹¹ Over the 1980s then, $wg \sim$ is expected to drop (exogenously) for a given level of unemployment. Furthermore, as noted above, the model predicts that shifts of employment out of the goods sector result in an endogenous decline in goods sector wages and wage convergence between the sectors.

Wage developments in the 1980s confirm these predictions. Average real hourly wages for production and nonsupervisory workers appear in Table 1.

TABLE 1
NONSUPERVISORY WAGES

| | Services | Goods | Manufacture | All Private Non-Agricultural |
|---------|----------|---------|-------------|---------------------------------|
| 1979 | \$7.17 | \$10.17 | \$9.23 | \$8.48 |
| 1989 | \$6.97 | \$9.28 | \$8.47 | \$7.79 |
| Δ 79-89 | -2.8% | -8.8% | -8.3% | -8.1% |
| 1985 | \$6.91 | \$9.69 | \$8.87 | \$7.96 |
| Δ 85-89 | 0.9% | -4.2% | -4.5% | -2.1% |

Sector wages are weighted averages based on Bureau of Labor Statistics *Employment and Earnings* data deflated with the Consumer Price Index (1982-84 = 100). If the Personal Consumption deflator from the GNP accounts (1982 = 100) is used to calculate real wages, a similar trend emerges, though the real declines are smaller: For goods the average wage drops from \$9.37 to \$8.78 between 1979 and 1989. For services it drops only one cent from \$6.69 to \$6.68.

Concerning the COJL, a number of simple assumptions on the model's parameters yield the estimations shown in Table 2 for the years in question.

Here the unemployment rates for 1979 and 1989 (both business cycle peaks) are nearly equal, suggesting that the observed changes in COJL are exogenous, not endogenous; moreover the combined drop in real wages and COJL cannot possibly be an endogenous response to a small drop (or any change) in unemployment. In the goods sector a 9% decline in real wages over the decade is accompanied by an 11% drop in $wg \sim$. The exogenous shift in $wg \sim$ suggests declining labor bargaining power in goods over the decade. For services, on the other hand, the declines in the COJL and the real wage are more modest, suggesting a smaller decline in labor's bargaining power.

The changes between 1985 and 1989 reinforce this impression of declining bargaining power in goods. Services experience a modest decline in the COJL and a modest rise in the real wage, suggesting an endogenous response to the post-1985 drop in unemployment. For goods on the other hand, the 1985 COJL is nearly equal to the 1979 COJL — despite the noticeable rise in unemployment. This suggests some decline in the exogenous portion of $wg \sim$ between 1979 and 1985. After 1985, $wg \sim$ drops dramatically (virtually all of its drop over the decade) despite the drop

TABLE 2
ESTIMATED COST OF JOB LOSS
AND CIVILIAN UNEMPLOYMENT

| | wc ~ (services) | wg ~ (goods) | Unemployment |
|---------|--------------------|-----------------|---------------|
| 1979 | \$1.68 | \$3.26 | 5.8% |
| 1989 | \$1.61 | \$2.89 | 5.3% |
| Δ 79-89 | -4.1% | -11.4% | -.5% (points) |
| 1985 | \$1.63 | \$3.25 | 7.2% |
| Δ 85-89 | -1.2% | -11.1% | 1.9% (points) |

Calculations are based upon the following simple assumptions concerning the parameters:

- a) Former service workers have 1/2 the chance of obtaining employment in the goods sector as former goods workers ($m = .5$);
- b) Unemployment benefits are half of each sector's hourly wage and 50% of unemployed workers receive benefits, thus on average: $uc = .25wc$ and $ug = .25wg$;
- c) The parameters $\alpha = \lambda = \delta = .8$.

The final assumption is clearly arbitrary.

This table is meant to show trends; it should not be interpreted as a precise calculation of the cost of job loss.

in unemployment; at the same time real wages continue to drop. These changes unambiguously indicate an exogenous shift in $wg \sim$ for the latter period, suggesting that labor's bargaining power in goods declines during economic expansion of the late 1980s.

This relatively simple model is able to account for several notable aggregate wage developments of the 1980s in response to institutional, union, import and employment developments. It suggests that wage convergence between the sectors observed during the 1980s is the combined result of industrial shift and a relatively large decline in labor's bargaining power in the goods sector; moreover the relatively large declines in real wages for nonsupervisory workers in the goods sector over the 1980s, notably since 1985, are (at least partially) the result of declining labor bargaining power and employment loss in the goods sector.

NOTES

1. Goods here include mining, construction, manufacturing and transportation, communications and utilities and the service sector includes wholesale, retail, finance, insurance, real estate and "services." Transportation, communication and utilities could be placed in either sector; however, with respect to wage setting in this model, these industries more closely resemble "goods."

Note the sectors here are *not* proxies for primary and secondary sectors arising from labor segmentation theories, rather they reflect concern with the shift toward a service economy expressed by such diverse authors as Victor Fuchs (1968) and Harrison and Bluestone (1988). Clearly an altered and extended (future) model could incorporate segmentation.

2. A key macroeconomic result here is that the overall labor market does not clear. Note these models do not assume that workers are lazy, just that they do not want to work as hard as their bosses would like.

3. It is not necessary to assume that all laid-off workers obtain unemployment benefits, only that some fraction of them do, so that on average laid-off workers receive some positive benefit.

4. Assumption iii is consistent with the literature on inter-industry wage differentials, for example, Dickens and Katz (1987).

5. Marglin (1984) argues that a key attribute of a Marxian macro-model is an exogenously determined wage which reflects social and technical factors. This model takes the motivating effect of the wage for a given level of unemployment, but not the wage itself, to be exogenous. Note it might have been simpler to argue that the wage level reflects labor's bargaining power, which is true. Focusing on the COJL however brings in the effort-wage relation of these models: it argues that bargaining power reflects the wage-effort tradeoff, not just the wage.

6. The intuition behind this result is that an increase in each sector's own level of employment reduces the denominator of the ratios in equations 3' and 4', whereas a drop in the other sector's level of employment reduces only one (goods) or two (services) terms in the numerator.

7. The "prior to employment" condition avoids contradiction with the assumption v.

8. Another logical candidate here is the technology of production in each sector. Bowles (1985) analyzes implications of various configurations of technology on labor extraction. This issue is not pursued here, but could be incorporated into a more complete analysis.

9. See Ferguson (1989) for a bargaining model along these lines.

10. Between 1979 and 1989 merchandise imports increased from \$212 billion to \$446 billion. Over this period, goods sector employment dropped from 26.5 million to 25.6 million and manufacturing employment fell from 21.0 million to 19.6 million. For services, on the other hand, employment rose from 63.4 million to 82.9 million over the same period (*Economic Report of the President* 1990).

11. Rising import penetration increases the elasticity of demand for domestic labor.

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