Labor Discipline and Aggregate Demand: A Macroeconomic Model

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By Samuel Bowles and Robert Boyer*

The neoclassical theory of employment and output may be characterized by its two most basic abstractions: the acceptance of Say's law and the representation of labor as a commodity like any other input. In practice, Say's law is nothing more than the assertion that product market clearing will be achieved through some combination of price level and interest rate effects, and that the process by which these effects work is sufficiently rapid and regular to justify abstracting from other possible consequences of the failure of markets to clear, such as quantity adjustments. The representation of labor as a commodity denies its more obvious status as human activity motivated in part by the intentions of the worker, and disciplined, if possible, by the employer; in practice it entails the assertion that the amount paid for an hour's work, and the amount of work done in an hour are taken by the firm as exogenously determined.

In this essay (and a series of related papers), we integrate the two absences in the neoclassical theory: the Keynes-inspired analysis of aggregate demand and the Marx-inspired analysis of the problem of wage setting labor discipline. Our model expresses a very simple underlying logic: the distribution of income is a key determinant of aggregate demand through its effects on savings and investment; the distribution of income is in turn the outcome of a class conflict over work and pay in which the balance of class forces is dependent on the level of employment and hence on the level of aggregate demand. Through its effect on the bargaining power of workers and em-

ployers, the level of government redistributive expenditure will influence both the distribution of private incomes and, independently of this, the level of aggregate demand; it will be modeled explicitly and generated endogenously. As we will see, taking account of the effect of the wage on both aggregate demand and the endogenous determination of output per labor hour, the level of employment may respond either positively or negatively to changes in the wage rate, giving rise to what we term a wage-led or profit-led employment regime, respectively.

I. Equilibrium Wages and Employment Rents in a Labor Extraction Model

Production of a single commodity using homogeneous labor is described jointly by a production function and labor extraction function, the latter representing a dismissal threat system of labor relations governing the pace of work:

$$(1) \qquad Q = qhe \qquad e = e(w_c)$$

$$\text{and} \qquad w_c = w - \left(hw_a + (1 - h)w_u \right),$$

where Q is total output, q is the level of output per unit of work performed, h is the fraction of a given level of labor supply (normalized as unity) that is employed, e is work effort performed per hour of labor employed, w_c is the worker's expected income loss associated with losing his or her job (the employment rent or cost of job loss), w_a is the worker's expected income in alternative employment and w_u is the level of income-replacing social benefits that the worker may expect to receive should the job be terminated. We assume throughout that $w > w_u$. The labor extraction function, $e(w_c)$, is derived from the workers' optimal choice of work effort given the cost of job loss; under quite general conditions it will be the

case that wage increases induce greater effort, though at a diminishing rate: $e' > 0$ and $e'' < 0$. The average product of work, q, is assumed to be independent of the level of employment, the result of unutilized capital stock of homogeneous quality and constant returns to scale; for convenience q is set equal to unity and dropped from further consideration.

As the microeconomics of this and analogous systems have been explored in a number of our related papers (for example, 1987), and elsewhere by George Akerlof and Janet Yellen (1986), Joseph Stiglitz (1987), and others, it will be sufficient to comment that the competitive profit-maximizing employer will vary the wage offered to labor in order to minimize w/e, the cost of an effective unit of labor, balancing the direct cost of the wage payment against its positive effect on the cost of job loss and hence on effort. Assuming that the firm regards all of the components of w_c except w as exogenous, the first-order conditions entailed by this optimization process are that the firm's optimal (cost-minimizing) wage, w^0, is such that the marginal effectiveness of a wage change on effort must be equal to the average effort per dollar of wage payment, or

$$(2) \quad e' = e/w^0 \quad \text{or} \quad w^0 = e(w_c)/e'(w_c)$$
$$= w^0(w_u, w_a, h).$$

The firm's optimal wage w^0 rises with the employment rate: as unemployment falls the best the employer can do is to pay workers more, offsetting the workers' greater employment security by increasing the hourly wage loss associated with job termination. Differentiation of (2) indicates that

$$(3) \quad dw^0/dh = (1 - e'/we'')(w_a - w_u).$$

The firm's first-order conditions (2) plus the labor market equilibrium condition that homogeneous labor must receive the same wage (or $w = w_a$) allow us to define the equilibrium wage, w^*. Taking account of both conditions, the change in the equilibrium

wage induced by a change in employment is

$$(4) \quad dw^*/dh = \frac{dw^0/dh}{1 - h(1 - e'/we'')}.$$

The inverse of the denominator may be interpreted as a multiplier reflecting the fact that each employer's wage increase raises the worker's alternative wage, lowering the cost of job loss and hence inducing further wage increases. Equation (4) describes a high-employment wage explosion: as h approaches a limit employment level, h_{max}, what we term the wage explosion multiplier becomes infinite, driving equilibrium wages to infinity. From (4) it can be seen that

$$(5) \quad h_{max} = (1 - e'/we'')^{-1}.$$

This wage explosion employment limit is clearly less than unity, as e' and w are positive and e'' is negative. Thus we may summarize the production and labor extraction side of the model by the wage determination function:

$$(6) \quad w^* = w^*(h)$$

with $dw^*/dh > 0$ for $w > w_u$ and $h < h_{max}$

which may be interpreted as a condition for the stationarity of w. Not surprisingly, along the equilibrium wage function, profit per hour of labor employed, $e - w$, falls as the employment rate rises.

It will be important to note for what follows that if we confine ourselves to labor market equilibria, such that $w = w_a$, the cost of job loss is

$$(7) \quad w_c = (1 - h)(w - w_u).$$

Thus, considering a given wage rate, two effects will determine the impact of employment rate rises on the movement of the total profits, r (which given a particular level of capital stock normalized at unity, is also the profit rate): increasing h will tend to raise r if profit per hour of labor is positive, but will tend to lower r through the negative effect

of increased labor market tightness on the cost of job loss $(-(w - w_u))$ and hence on labor intensity. Thus

$$(8) \qquad r = h(e - w)$$

and $dr/dh = e - w - he'(w - w_u)$,

indicating that for positive profits as h rises r will first rise and then fall, describing a high-employment profit squeeze.

Correspondingly, the effect on total profits of a wage increase (for a constant h) reflects a positive labor intensity effect operating indirectly via the impact of the wage increase on cost of job loss $(1 - h)$, offset by a negative direct wage effect. It will be unambiguously negative in the neighborhood of the firm's optimum:

$$(9) \qquad dr/dw = h\{e'(1 - h) - 1\} < 0$$

$$\text{for} \quad w > w_{r\,\max}$$

(The bracketed expression on the right will be zero at the wage, $w_{r\,\max}$, which maximizes total profits for a given level of employment, and hence would be set by a single profit-maximizing cartel; from (1) and (2) it can be shown that the atomistically competitive wage w^* exceeds $w_{r\,\max}$ for reasonable values of h.)

II. Wage-Led and Profit-Led Employment in an Aggregate Demand Model

Turning now to the demand side of the model, we seek a stationarity condition for h based on the demand for labor. We will simplify matters greatly and highlight the effects of income distribution on aggregate demand by making both savings and investment depend on the level of profits. Investment will thus depend both on the activity level of the economy (h) and the cost conditions facing employers ($e - w$). We assume that the fraction of profits saved is s_r and that all wages are consumed. We abstract from taxation, assuming that the government borrows an amount equal to autonomous borrowing, b_0, plus the endogenously generated level of income-replacing social pay-

ments $((1 - h)w_u)$. Thus (abstracting from net exports) the components of aggregate demand and their relationship to aggregate supply may be expressed:

$$(10) \qquad i = i_0 + i_r(h(e - w))$$

$$c = h(w + (1 - s_r)(e - w));$$

$$b = b_0 + (1 - h)w_u \quad \text{and} \quad he = i + c + b$$

where i, c, and b are, respectively, investment, privately financed consumption, and government spending (borrowing), all expressed as a fraction of the capital stock.

We may express the demand for labor as the total demand for goods divided by the (endogenously generated) average product of labor, or equivalently as the level of employment at which intended investment is equal to intended private savings (s) minus government borrowing. Both imply that firms are demand constrained: they will hire more labor if excess demand for goods (D_x) is positive. More generally, the rate of change of employment, $\dot{h}$ is

$$(11) \qquad \dot{h} = H(D_x)$$

where $D_x = i + b - s$,

$$H' > 0 \quad \text{and} \quad H(0) = 0.$$

Using (10) and (11) we can write excess demand as an implicit function in h and w, and interpret this function as a stationarity condition for h when $D_x(h, w) = 0$.

This product market-clearing condition indicates the effect of a wage change on the equilibrium level of employment: a wage-led employment regime is said to obtain if this effect is positive. The occurrence of a wage-led or (its converse) a profit-led employment regime will depend on the relative importance of the high-employment profit squeeze, the size of the unemployment benefit, and the responsiveness of both savings and investment to the profit rate. For example, one variant of a wage-led regime will obtain if the effect of a wage increase is to increase consumption more than it lowers investment (thus generating excess demand) and if an

employment increase will have the effect of reducing excess demand (through its effect on profits and hence on savings and investment as well as on government borrowing). In this case, in order for product markets to clear, the excess demand induced by a wage increase must be offset by an excess demand-reducing employment increase; given the demand constrained nature of the firms' employment decision, their autonomous actions will in this case generate the equilibrating movement.

III. Wage-Led and Profit-Led Employment Regimes

The slope of the product market-clearing condition, dh^*/dw, is evidently worth closer inspection, for it determines whether an employment regime will be wage-led or profit-led. From (8) through (12) we may write

$$(12) \quad dh^*/dw = (dDx/dw)/(-dDx/dh)$$

$$= \frac{dr/dw(i_r - s_r)}{-dr/dh(i_r - s_r) + w_u}.$$

Because (from (9)) dr/dw is negative near the firm equilibrium, the sign of the numerator depends solely on whether investment responds more or less than savings to a change in profits: we term the former a case of investment-led aggregate demand; the latter is consumption-led. The sign of the denominator depends not only on $(i_r - s_r)$, but also on the size of the unemployment benefit, and on the effect of variations in employment on profits and hence on the labor extraction function. From (8) we know that dr/dh may be of either sign and because of the high-employment profit squeeze is likely to be negative for high levels of h. On the basis of the savings investment behavior and the importance of the profit squeeze relative to the size of the unemployment benefit, we can distinguish the four cases presented in Figure 1.

The wage-led employment regime based on consumption-led aggregate demand described above appears in the upper right cell and is illustrated in Figure 2. As saving is

Production and labor relations:	Aggregate Demand is	
	Investment-led $(i_r > s_r)$	Consumption-led $(i_r < s_r)$
Insignificant profit squeeze	WAGE-LED i.e., $dh^*/dw > 0$ because $dDx/dw < 0$ and $dDx/dh > 0$	WAGE-LED i.e., $dh^*/dw > 0$ because $dDx/dw > 0$ and $dDx/dh < 0$
Significant profit squeeze	PROFIT-LED i.e., $dh^*/dw < 0$ because $dDx/dw < 0$ and $dDx/dh < 0$	PROFIT-LED $dh^*/dw < 0$ because, $dDx/dw > 0$ $dDx/dh > 0$

FIGURE 1. WAGE-LED AND PROFIT-LED EMPLOYMENT REGIMES

more profit responsive than is investment, dDx/dw is positive; and as the full-employment profit squeeze is insignificant, dDx/dh is negative yielding a positively sloped market-clearing function. (From (9) and (12) it can be seen that $h^*(w)$ is vertical at the cartel profit-maximizing wage, $w_{r\,max}$.) In Figure 2, horizontal arrows indicate the sign of excess demand (and hence, by (11), the sign of dh); the vertical arrows indicate the out of equilibrium adjustment of the wage. The values w^{**} and h^{**} represent a stable unemployment equilibrium in which $dh^*/dw > 0$, that is, a wage-led employment regime.

An increase in the employment rate will, as we have seen, change the sign of dr/dh from positive to negative; this high-employ-
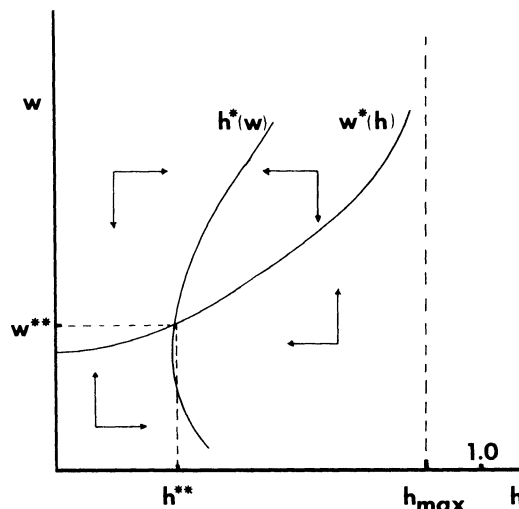

FIGURE 2. A WAGE-LED EMPLOYMENT REGIME

ment profit squeeze may eventually dominate dDx/dh, changing the sign of dh^*/dw. The critical value $h_{\lim}$, at which dDx/dh is zero and hence the sign of dh^*/dw changes, is the limit of the wage-led employment regime. (The dividing line between the "insignificant" and "significant" profit squeeze in Figure 1 is, of course, $h_{\lim}$.) Equilibria for $h > h_{\lim}$ are necessarily unstable as long as savings is more responsive to profits than is investment.

Interestingly, in the consumption-led aggregate demand case, this limit will occur at a higher level of employment the larger is the unemployment benefit. This is because with a large unemployment benefit, employment increases will tend to enhance net savings $(s - b)$ by inducing a larger reduction in government borrowing to offset the employment-increase-induced rise in privately financed consumption, and because the high-employment labor intensity squeeze will be attenuated. It is clear from (8) that as w_u approaches w, the high-employment profit squeeze will vanish, as it is based on the increase in worker security as employment rises. Thus there need not be a regime shift from wage-led to profit-led over the feasible range of employment levels.

Consider, now, the investment-led case, in which $i_r > s_r$. Here dDx/dw is unambiguously negative, as the negative wage effects on investment dominate the positive wage effects on consumption. In this case, a stable equilibrium will exist when dDx/dh is negative, which for $i_r > s_r$ will occur for sufficiently high levels of employment and unemployment insurance, illustrated in Figure 3. We may call this employment regime profit-led, as the equilibrium level of employment is a negative function of the wage rate.

The upper unemployment limit of the profit-led employment regime is set by the wage explosion dynamic outlined above: $h_{r\,zero}$ may be defined as the level of h for which $(e - w)$ goes to zero. Or, to take an extreme but simple alternate case, we may assume that investment responsiveness to profits is infinite at some given level of profit, r, (perhaps due to a global hypermobility of capital that establishes a common world profit rate). In this case, we may simply
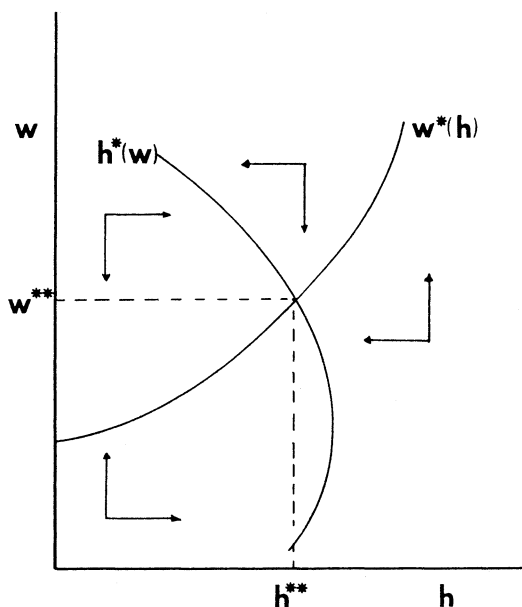

FIGURE 3. A PROFIT-LED EMPLOYMENT REGIME

ignore all the non-i_r-related terms in (12), and note that the resulting expression for dh^*/dw is an isoprofit function written in h, w space defining the level of profits r. Given the assumptions, product market clearing can only be achieved at one level of profit, the level of employment being determined as that which generates this level.

Our last case—wage-led employment in an investment-led demand regime—is at once paradoxical and possibly of some concrete relevance. In this configuration, illustrated in Figure 4, an increase in wages and employment generate, respectively, a decrease and an increase in aggregate demand. The resulting positively sloped market-clearing function may have more than one intersection with the equilibrium wage function, as is shown. Point a describes a wage-led employment regime, but with this element of paradox: to generate a simultaneous increase in the equilibrium wage and employment level, a *downward* shift in the wage function is required. We may describe this as a collective wage-led employment regime to high-
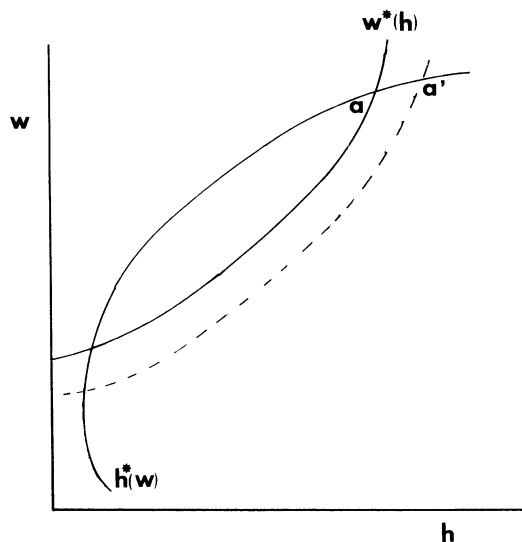
FIGURE 4. ANOTHER WAGE-LED EMPLOYMENT REGIME

light the fact that the joint expansion of employment and wages is obtained through organized wage restraint in the form of workers agreeing not to use the increase in bargaining power which increased employment levels confer on them.

IV. Labor Relations and Macroeconomic Theory

What has been the upshot of our simultaneous rejection of both Say's law and the representation of labor as a commodity?

First, our model exhibits a high-employment profit squeeze, giving rise to a limit level of employment which is less than full employment. Beyond this employment level, aggregate demand expansion policies will be ineffective in the absence of institutional changes in the organization of the labor market and work process designed to replace the dismissal threat based system of labor control.

Second, we identify quite general conditions supporting a wage-led employment regime. However, even if we were to adopt assumptions which would appear quite

favorable to a wage-led employment regime —exogenous investment demand and no savings out of wage income—a wage-led employment regime is not guaranteed, and because of the high employment profit squeeze will generally not obtain at high levels of employment.

Third, reductions in the difference between the wage and income-replacing social payments such as unemployment insurance, will expand the range of employment rates over which wage-led employment regimes may obtain. Thus there may be a symbiotic quality to the social democratic program that has insisted that wage increases in conjunction with the expansion of the welfare state may enhance employment.

Fourth, even if investment is highly responsive to profits, a wage-led employment regime may nonetheless obtain, but enjoying of its obvious advantages—a simultaneous increase in equilibrium wages and employment—may require collective action by unions, employers, or states to insure wage restraint.

Fifth, at high levels of employment and with investment highly responsive to profitability, wage-led growth is precluded, as aggregate demand comes to be dominated by the negative effect of wage increases on investment.

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