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ABSTRACT

In efficiency wage models firms set employment so that the value of the marginal revenue product of labor (VMRPL) equals the wage. If the payment of efficiency wages results in inter-industry wage differences for comparable workers there exist welfare enhancing industrial and trade policies which shift employment from low to high wage industries. Previous attempts to measure the potential impact of such policies have assumed that wages equal the VMRPL, but not all explanations for inter-industry wage differences have that property.

This paper argues, from the evidence on inter-industry wage differences that rent-sharing/extraction models should be preferred to other explanations. However, such models do not all have the property that wages equal the VMRPL. In the model presented VMRPL is set equal to the opportunity cost of labor so policies to shift employment to high wage industries would be of no value. Further, the empirical work that has been done to assess the importance of labor market distortions for trade and industrial policy is inapplicable if such models are the correct explanation for inter-industry wage differences.

A rent-extraction model that takes into account workers' limited information about the profitability of the company they work for is developed. In that model high wage industries have high VMRPL so policies to shift employment to high wage industries are appropriate and past empirical studies of the effects of trade and industrial policy are approximately correct.

William T. Dickens
Department of Economics
University of California
Berkeley, CA 94720
(415)642-4308

The last decade has seen considerable interest in models of labor markets that don't clear including efficiency wage, rent-sharing or rent-extraction models. In efficiency wage models firms set employment so that the value of the marginal revenue product of labor (VMRPL) equals the wage. If the payment of efficiency wages results in inter-industry wage differences for comparable workers there exist welfare enhancing industrial and trade policies which shift employment from low to high wage industries.

Two papers have attempted empirical assessments of the importance of such considerations: Dickens and Lang (1988) and Katz and Summers (1989). In both papers the authors assume that firms set employment so that the VMRPL equals the wage. However, not all explanations for inter-industry wage differences have that property.

This paper begins by reviewing the evidence on inter-industry wage differences and argues that we should prefer rent-sharing/extraction models over other explanations. Second, it is argued that in the most attractive rent-sharing/extraction models the wage does not equal the VMRPL. In the model presented VMRPL is set equal to the opportunity cost of labor so policies to shift employment to high wage industries would be of no value. Further, the empirical work that has been done to assess the importance of labor market distortions for trade and industrial policy is inapplicable if such models are the correct explanation for inter-industry wage differences.

Finally, a rent-extraction model that takes into account

workers' limited information about the profitability of the company they work for is developed. In that model high wage industries have high VMRPL so policies to shift employment to high wage industries are appropriate. Previous empirical studies can be interpreted as yielding close approximations to the effects of trade and industrial policies.

Inter-Industry Wage Differences and Models of Wage Determination:

Five papers review the evidence on inter-industry wage differences (Dickens and Katz 1987a&b, Krueger and Summers 1987&88 and Katz and Summers 1989). All conclude that models in which the labor market does not clear allow a better explanation of the facts than any model in which it clears. Most of these papers also conclude that rent-sharing/extraction models should be preferred among the class of models where labor markets do not clear. Lindbeck and Snower (1988b) also make this argument. The two most important facts in this regard are the correlation of wages with industry profitability and the high correlation of wages across occupations within industries -- industries which pay their production workers more than other industries pay all occupations more.

Both observations are difficult to reconcile with standard theories of efficiency wages which explain differences in workers' wages as due to differences in the costs of monitoring or replacing workers, or to the extent of unobservable differences in productivity.

It is possible to explain the correlation with profitability

in a shirking efficiency wage model with heterogeneous workers. In such a model the efficiency wage depends not only on the monitoring technology but also on the cost to the firm of shirking. If shirking is more costly if each worker is working with more capital, then profits per worker or profits as a percent of sales may be correlated with wages since both those measures of profits would be correlated with capital intensity. The wages of production workers could be determined in this manner and the correlation of wages across occupations could result from norms of fairness.

This argument is unconvincing for two reasons. First, Dickens and Katz (1987a) find that capital-per-worker has a more tenuous relation to wages than profitability and that the correlation between profits and wages persists when controlling for the capital/labor ratio. Second, it is difficult to reconcile efficiency wages with the size of inter-industry wage differences. The premium necessary to deter shirking is amortized over a workers entire career. In high wage industries job durations are long so that even if the probability of apprehension is low and the utility value of shirking high, increases in wages would be small. Finally, norms of fairness are a poor explanation for long-run phenomena. Although difficult to manipulate in the short-run, norms of fairness are subject to change over time. By changing educational requirements, organizational structure, or even job titles the jobs a worker compares his or her wage to can be changed.

Rent-sharing/extraction models provide an obvious explanation for the correlation between industry wage premiums and industry profitability. As long as all occupations in an industry are receiving some rent the surplus of their wages above the market clearing wage will be proportional to profitability and therefore correlated with the wage of other occupations in the industry. Further, the bargained surplus should be proportional to the flow of surplus and can, therefore, be large.

Policy Implications of Rent-Sharing/Extraction Models:

In standard efficiency wage models the wage paid does not depend on the level of employment. Although it is not exogenously given to the firm, the wage is determined by parameters which are unaffected by any individual firm's hiring decisions. Thus for the purposes of determining employment the wage is exogenous and the firm hires workers up to the point where the VMRPL is equal to the wage. This is not true of most rent-sharing/extraction models. Consider the simplest of them which is presented below. In this model workers expect the firm to pay them at least their reservation wage. Since they contribute to the performance of the firm they also expect to receive a share of the profits from the firm.[1] As in other normative wage models workers who do not receive the wage they expect will withhold labor. The firm can not profit by replacing such workers since new workers will behave the same way. Thus the firm pays the normative wage which is written

$$(1) \qquad w = r + s\ (\ R(L)/L - r\ )$$

where w is the wage, r the workers' reservation wage, s the share

of profits workers expect to receive, and R(L)/L revenue net of non-labor costs per worker. The term in parenthesis is the profits per worker available after paying labor its opportunity cost. Substituting (1) into the firms profit function rearranging terms and differentiating yields the first order conditions for a maximum with respect to L

$$(2) \quad dpi/dL = (1 - s) (R'(L) - r) = 0$$

or

$$R'(L) = r.$$

Thus while there may be unemployment in a world populated by such firms in the sense that there are workers who would like to work at the going wage who the firms won't employ, there is no potential gain to efficiency from increasing employment (as there is in the standard efficiency wage model). Further, as long as the reservation wage is equal across industries the VMRPL will be equal across industries and there will be no argument for policies favoring employment in one industry as opposed to another or for favoring high-wage industries in trade policy[2]. Finally, the empirical analysis of the effects of trade and industrial policy done in Dickens and Lang (1988) and Katz and Summers (1989) are inappropriate since they assume that firms are setting their VMRPL equal to the wage.

This result is not unique to this model. Rather it is typical of this class of models. If rent-sharing results from collective bargaining most models of union behavior suggest that the VMRPL should be equal to or less than the reservation wage.[3] If rent is

being extracted by workers by virtue of a threat of collective action as in Dickens (1986) or Lindbeck and Snower (1986,1988b) then again the VMRPL may not be set equal to the wage.[4]

Expense preference models are a class of rent-sharing models that may not be subject to this criticism. In these models utility maximizing managers choose between spending firm profits on extra salary and perks for themselves or on wages for workers to make the managers' lives easier and more enjoyable (this assumes that higher paid workers are easier to manage and more pleasant to work with). Managers may dispose of firms' profits in this manner because they are subject only to a minimum dividend constraint, or some other weak agency constraint. In such models the wage will equal the VMRPL as long as firm size or employment don't also enter the managers' utility functions.

Such models are unattractive for several reasons. First, given the size of inter-industry wage differences it is hard to believe that either stock-holders or take-overs wouldn't enforce the discipline of the market place on such managers. It is easy to believe that managers could spend quite lavishly on themselves without sufficiently lowering the return on equity. However, paying wage bonuses of greater than 10% would cost an order of magnitude more than Persian rugs and helicopters for managers and would certainly invite take-overs if not disciplinary action by stock-holders.

Finally, it is likely that firm size does enter into the calculation of managers utility -- expense preference was used to

explain firms' interest in market share long before it was used to explain inter-industry wage differences. In that case the VMRPL would be set below the wage and might be only tenuously related.

For these reasons the most attractive rent-sharing/extraction models are the ones that have the property that wages are not a good indicator of the VMRPL. This is itself an unattractive property. I have never heard a manager say, "In planning this lay-off remember that the shadow price of labor is actually less than the wage because by hiring more workers we lower profits per worker and can get away with paying them less." If managers aren't explicitly thinking this way its hard to imagine how their behavior could lead to this result.

Even if they did think this way it is hard to imagine that workers would let them get away with it. In the absence of a union most workers probably know very little about the profitability of the firm. To get some idea of what their firm might be able to pay them they look at what comparable firms are paying and adjust that by what they know about the unique circumstances of their firm (Ross 1948, Dunlop 1957). Thus their wage expectations are unlikely to be affected much by the hiring decisions of their own firm.

Rent Sharing With Imperfect Information About Rents:

Consider again the normative rent-sharing model introduced in the last section. Now however, let's examine what happens if workers have less than perfect information about net-revenue per worker. In the absence of other information we might expect them to substitute their best guess about net-revenue per worker for

the real thing. As long as their best guess is an unbiased estimator this should not affect the expected value of the wage nor any of the outcomes. However, workers might reasonably believe that the wages paid by other similar firms contain information about the state of the product market in which their firm participates as well as the state of the economy. Consequently they may use them as additional signals of the profitability of their firm. To the extent that own wages are a function of the profitability of other firms they are exogenous to the particular firm and will be treated accordingly in hiring.

The model presented below has the property that workers optimally use the information available in the wages of other firms. This yields a very simple formula for the normal wage as a function of the reservation wage, net-revenue per worker, and the average wage of comparable firms. As the number of comparable firms becomes large the VMRPL increases until it is equal to the wage.

Suppose that workers at firm 1 expect to be paid according to (1) but do not know the true value of $R_1(L_1)/L_1$ -- only an unbiased estimate. They also know the value of wages paid by N-1 other firms w_i for i=2 to N. Assume also that they know that wages at those firms are set in the same manner as wages at their firm and that the workers at those firms have a signal on $R_i(L_i)/L_i$ which they use in determining their wage demand. It will be assumed that $R_i(L_i)/L_i$ is an independent signal of the value of $R_1(L_1)/L_1$ and that the ratio of the variance of the estimate of $R_1(L_1)/L_1$ based on

information from firm i to the one based on the signal from firm 1 is a. Then they will want to form their wage demand as in (1) substituting

$$(3) \quad (a\ ER_1 + \sum_{i=2}^{N} ER_i) / (a + N - 1)$$

for $R_1(L_1)/L_1$ where ER_i is the best estimate of $R_i(L_i)/L_i$ given the information available to the workers in firm i. The information on ER_i is available in w_i, but extracting it poses something of a problem.

If workers in firm 1 use the information in the wages of workers at other firms in forming their wage demands then certainly the workers at the other firms are looking at the wages in firm 1. Workers in firm one must take this into account. However, if they do that then other workers must behave in a similar fashion and we find ourselves in an infinite regress.

Luckily, the solution to the infinite regress is simple. Sufficiently simple that it seems reasonable to believe that workers' intuitive solutions to this problem might well provide a close approximation to the optimal solution and thus allow the "evolutionary" survival of such behavior.[5]

To begin with suppose the solution takes the form

$$(4) \quad w_i = c_1 r + c_2 w_{-i} + c_3 ER_i$$

where w_{-i} is the average wage paid by firms other than i and c_1, c_2 and c_3 are constants to be determined below. Then ER_i is easily determined as $(w_i - c_1 r - c_2 w_{-i}) / c_3$. Substituting this into (3), (3) into (1) and rearranging terms yields

$$(5)\quad w_i = \{[(1-s)(a+N-1)-(sc_1(n-1))/c_3]\ r + sa\ ER_i + [s(N-1)\ w_{-i} - sc_2\ (w_i + \sum_{\substack{j=1\\ j\neq i}}^{N} [w_{-j}-w_i/(N-1)])]/c_3\}/(a+N-1).$$

Noting that $\sum_{\substack{j=1\\ j\neq i}}^{N} [w_{-j}-w_i/(N-1)] = (N-2)\ w_{-i}$ rearranging terms, and solving for w_i yields a solution of the same form as equation (5). Setting the coefficients of r, w_{-i} and ER equal to c_1, c_2 and c_3 respectively and solving yields

$$c_1 = (1-s)([a+N-2]a-[N-1])/d,$$

$$c_2 = (N-1)(a+N-1)/d,$$

and

$$c_3 = s([a+N-2]a-[N-1])/d$$

where

$$d = (a+N-1)(a+N-2).$$

Note that the numerators of c_1 and c_3 are of order N while the numerator of c_2 and the denominator d are of order N^2. Thus for large N, c_1 and c_3 are essentially zero and c_2 is equal to 1 and each firm's wage is approximately exogenously given as the average of the wage of other similar firms.

What will that wage be? Substituting (4) into the definition of w_{-i}, and then rearranging terms yields

$$(6)\quad w_{-i} = \{c_1(N-1+c_2)r + c_2(w_i+(N-2)w_{-i}) + c_3ER_{-i}\}/(N-1)$$

where ER_{-i} is the average value of ER_j for j not equal to i. Substituting (4) in for w_i, solving for w_{-i} and taking the limit as N goes to infinity yields

$$(7)\quad w_i = w_{-i} = (1-s)\ r + s\ ER_{-i}.$$

What is a large N? That depends on the size of a. If information on ones own firm is three times as informative about

profitability as information on the average comparable firm then with 9 comparison firms c_2, the weight on w_{-i}, will equal 5/6. These are believable numbers and 5/6 is sufficiently close to one that the analysis in Dickens and Lang (1988) and Katz and Summers (1989) are reasonable approximations. Such numbers would also account for the lack of attention by managers to the potential for lowering wages by expanding employment.

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Notes

1. See Kahneman, Knetsch and Thaler (1986) for evidence that workers behave this way.

2. If R is not net of capital costs and s differs between industries then there are welfare improving differential subsidies to capital. Targeted trade or employment policies may be second best alternatives. However, industry wage differences will only be a guide to which industries to target to the extent that they reflect differences in s as opposed to differences in R(L).

3. This is the efficient contracts literature. See Ashenfelter and Brown (1986) for a discussion and some empirical evidence. See Oswald (1985) or Johnson (1986) for examples of models where the VMPL is equal to the wage or an increasing function of both the wage and the reservation wage.

4. This is true of all specifications of the union threat model Dickens (1986) considers except for one and then only in one regime. It is also true of the more attractive of the models considered by Lindbeck and Snower (1988b). Those that don't have this property also fail to yield a correlation between profits and wages.

5. The static nature of this model makes it seem less realistic than it may actually be. The equilibrium is the same as what would be arrived at if wages react through a series of sequential or simultaneous adjustments to new information.