WAGE-PRODUCTIVITY MARGINS AND MARKET STRUCTURE*

by

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NUMBER 225

WARWICK ECONOMIC RESEARCH PAPERS

DEPARTMENT OF ECONOMICS

UNIVERSITY OF WARWICK
COVENTRY

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*I am grateful to Keith Cowling and Roger Sugden for valuable comments.

This research was undertaken during the tenure of an SSRC Studentship.

March, 1983

1. INTRODUCTION

The main aim of this paper is to suggest a model which relates wage rates to the degree of monopsony power in the labour market.

Labour market monopsony power has received relatively little theoretical or empirical attention, yet there are a number of reasons for believing it may be a fairly general phenomenon. Firstly, imperfect worker information on the existence and characteristics of alternative jobs will tend to impart a positive slope to the supply curve of labour facing a firm. Secondly, there are many social and institutional barriers to geographical mobility. Finally, the literature on segmented labour markets emphasises the barriers to mobility between jobs even within a region.[1/]

Studies which have attempted to measure the impact of monopsony power on wages may be divided into two groups according to their methodology. The first approach involves attempting to estimate a worker's marginal revenue product. This is then compared with the wage paid and the proportional difference is sometimes referred to as the rate of monopsonistic exploitation. Using this procedure, Scully (1974) concluded that the monopsony power conveyed by the "reserve clause" in U.S. professional baseball players' contracts resulted in considerable exploitation of players. The second approach, which is the focus of this paper, is to include an employer concentration term in cross section wage equations. This approach has been used, for example, by Landon (1970) to study the wages of newspaper workers, Landon and Baird (1971) for teachers, and Link and Landon (1975) for Nurses. (All using U.S. data). In each case

the results suggest that increases in concentration are associated with lower wages. However in none of the studies was the estimating equation relating wages and market structure variables the outcome of an explicit theoretical model. It is simply asserted that since a monopsonist will pay a wage below the competitive level then increases in the degree of employer concentration will lead to lower wages. The purpose of this paper is to suggest a model which explicitly relates wages to labour market structure variables. We will employ the same methodology as in Cowling and Waterson's (1976) analysis of structure and performance in the product market.

The oligopsony model is described in section 2. In order to focus attention on the labour market it is assumed that firms face a fixed price, $\bar{P}$, for their product. The model relates the proportional excess of marginal revenue product over the wage rate to the market elasticity of labour supply, the degree of employer concentration, and a conjectural variation term which incorporates collusion or apparent collusion. Section 3 then extends the analysis to include product as well as labour market power. This is followed by a brief conclusion.

2. OLIGOPSONY WITH A FIXED PRODUCT PRICE

Consider a labour market in which N firms demand a homogeneous labour input L, defined as the number of workers each working a fixed number of hours. Each firm sells on output X_i at a given market price $\bar{P}$. We assume that firms aim to maximise short-run profits. Firm i therefore aims to

$$(1) \qquad \underset{L_i}{\text{Max}} \ \Pi_i = \bar{P}X_i(L_i) - wL_i - F_i$$

where Π_i is profit, F_i fixed costs, and w is the market wage rate given by

$$(2) \qquad w = f(L) = f(L_1 + L_2 + \ldots + L_N)$$

The first-order conditions for a maximum are

$$(3) \qquad \frac{d\Pi_i}{dL_i} = \bar{P}\frac{dX_i}{dL_i} - \left[w + L_i \frac{dw}{dL}\frac{dL}{dL_i}\right] = 0 \qquad ,(i = 1,\ldots,N)$$

or

$$(4) \qquad \bar{P}\frac{dX_i}{dL_i} - \left[w + L_i \frac{dw}{dL}(1 + \sigma_i)\right] = 0 \qquad ,(i = 1, \ldots, N)$$

where

$$(5) \qquad \frac{dL}{dL_i} = 1 + \frac{d\sum_{j\neq i} L_j}{dL_i} \equiv 1 + \sigma_i$$

We now need to distinguish the cases of identical and non-identical firms.

(a) Identical Firms

If firms have identical conjectures, σ, and production functions, $X(L)$[2/] then (4) becomes

$$(6) \qquad \bar{P}\frac{dX}{dL} - w + \frac{L}{N}\frac{dw}{dL}(1+\sigma) = 0$$

which can be rewritten as

$$(7) \qquad \frac{\bar{P}\frac{dX}{dL} - w}{w} = \frac{1+\sigma}{N\phi}$$

where $\phi = \frac{dL}{dw} \cdot \frac{w}{L}$

Thus in the case of identical firms the proportionate excess of the marginal revenue product over the wage rate is related inversely to the number of firms and the market elasticity of labour supply, ϕ, and directly to the conjectural variation term, σ. Note that if $N = 1$ then $\sigma = 0$ and so we obtain the familiar monopsony result

$$\frac{\bar{P}\frac{dX}{dL} - w}{w} = \frac{1}{\phi}$$

A problem for empirical work is that both ϕ and σ will typically be non-observable. However since the value of ϕ depends on the availability of substitutes some of the effect may be captured in cross section analysis by the ratio of vacancies to unemployment and the average level of wages in the region. The latter proved to be a significant variable in the studies by London (1970) and Link and Landon (1975) referred to earlier.

The conjectural variation term, α, depends both on the number of rivals and each firm's expectations about the response of rivals to its own employment decision. This latter element can be interpreted as the degree of apparent collusion. If each firm expects its rivals to fully match any adjustment to its own employment level then $\frac{dL_j}{dL_i} = 1 \quad \forall_{j \neq i}$, and so we would obtain the joint profit maximising solution $\frac{\bar{P}\frac{dX}{dL} - w}{w} = \frac{1}{\emptyset}$. This would therefore be interpreted as perfect (apparent) collusion. At the other extreme, the Cournot solution implies that $\frac{dL_j}{dL_i} = 0 \quad \forall_{i \neq j}$.

Employers may collude formally but, paradoxically, high values of $\frac{dL_j}{dL_i}$ may also result from rivalry between firms. This coexistance of rivalry and collusion has been discussed by Cowling (1982) in relation to the product market. Its basis is that the closer the rivalry the more immediate will be the response to any attempt to secure an advantage. This in turn makes a breakaway movement unprofitable and hence serves to maintain collusion. In terms of our model, then, close rivalry leads firms to expect that any attempt to raise their employment level would immediately be followed by other firms (that is, a high value of α for given N) and hence would be unprofitable. It may further be argued that the degree of apparent collusion is likely to increase with concentration since any attempt to secure an advantage by one firm will more easily be detected where the number of firms is small.[3/]

This analysis of collusion therefore suggests that the value of σ will fall less than in proportion to a reduction in N and hence is further reason for believing that the wage-productivity margin will rise as N falls.

Before leaving the issue of collusion we should note, briefly, that it need not relate only to levels of employment (and thus wage levels). Another possibility is that firms may collude to restrict the choice of firms available to workers, that is, to reduce N. This is, for example, the purpose of the "Reserve Clause" in professional baseball which was mentioned earlier. Similarly a study by Lester(1955) of manufacturing firms in New Jersey revealed the existence of an agreement between firms not to attract workers from each other. This type of collusion cannot be captured in our model since its effect is to make the number of alternatives facing a worker already employed differ from the number facing a worker who is considering entering the market.

(b) Non-Identical Firms

In order to derive the expression (7), it was assumed that firms were identical in both their production functions and conjectures. We can now examine the effect of relaxing this assumption.

Multiplying each term in (4) by L_i and summing over the N firms yields

$$\bar{P} \Sigma L_i \frac{dX_i}{dL_i} - wL - \frac{dw}{dL} \Sigma L_i^2 (1 + \sigma_i) = 0 \tag{8}$$

or

$$\frac{\bar{P} \Sigma L_i \frac{dX_i}{dL_i} - wL}{wL} = \frac{G(1 + \mu)}{\phi} \tag{9}$$

where $G = \Sigma \left(\frac{L_i}{L}\right)^2$ is the Herfindahl index of concentration in the labour market

and $\mu = \frac{\Sigma L_i^2 \sigma_i}{\Sigma L_i^2}$ is a weighted average of conjectural variation terms.

Comparing (9) with the expression for identical firms (7) we see that the left-hand side is now the proportionate excess of a weighted average of marginal revenue products over the wage rate. Similarly on the right-hand side the conjectural variation terms are weighted according to firm size. The model suggests the Herfindahl as the appropriate measure of concentration in explaining market outcome.

If the marginal product of labour is constant then the left-hand side of (9) is the share of wages in total revenue. It is therefore interesting to relate this to the finding of Cowling and Molho (1982) that, for the U.K., higher degrees of product market concentration are associated with lower wage shares. Their estimating equation is based upon Cowling's (1981) oligopoly model in which marginal costs are assumed constant. Such an assumption would imply a horizontal labour supply curve. Our analysis has shown that with an upward sloping labour supply schedule wage shares will vary inversely with concentration in the labour market. Thus, if there is an overlap between product and labour markets, the Cowling and Molho results may reflect market power in the labour market rather than product market. This discussion suggests that, ideally, both product and labour market conditions should be incorporated into the analysis. In the following section, therefore, oligopoly in the product market is incorporated into our model.

3. OLIGOPSONY WITH OLIGOPOLY

This section incorporates product market power into the model. For simplicity it will be assumed that the product and labour markets coincide exactly (that is, it is the same N firms in each) and the analysis will be restricted to identical firms. This will serve to illustrate the general form of the result; relaxing either restriction would introduce substantial complications.

Each aims to

$$\text{(11)} \qquad \underset{L_i}{\text{Max}} \; \Pi_i = P\, X_i(L_i) - wL_i - F_i$$

where P is the market price given by

$$\text{(12)} \qquad P = g(X) = g(X_1 + X_2 + \ldots + X_N)$$

As before, the wage rate is determined by (2). The first-order conditions for a maximum are

$$\text{(13)} \qquad \frac{d\Pi_i}{dL_i} = \left[P \frac{dX_i}{dL_i} + X_i \frac{dP}{dX} \frac{dX}{dL_i}\right] - \left[w + L_i \frac{dw}{dL} \cdot \frac{dL}{dL_i}\right] = 0 \;, \quad (i = 1,\ldots,N)$$

where

$$\text{(14)} \qquad \frac{dX}{dL_i} = \frac{dX_i}{dL_i} + \sum_{j \neq 1} \frac{dX_j}{dL_j} \frac{dL_j}{dL_i}$$

Given identical firms $\dfrac{dX_i}{dL_i} = \dfrac{dX_j}{dL_j}$, $\forall_j$ so we can write

$$\text{(15)} \qquad \frac{dX}{dL_i} = \frac{dX_i}{dL_i}(1 + \sigma)$$

Substituting (5) and (15) into (13) gives

$$(16) \qquad \left[P \frac{dX_i}{dL_i} + X_i \frac{dP}{dX} \frac{dX_i}{dL_i} (1 + \sigma)\right] - \left[w + L_i \frac{dw}{dL} (1 + \sigma)\right] = 0$$

Therefore

$$(17) \qquad P \frac{dX_i}{dL_i} \left[1 + \frac{1+\sigma}{N\eta}\right] - w \left[1 + \frac{1+\sigma}{N\emptyset}\right] = 0$$

where $\eta = \frac{dX}{dP} \cdot \frac{P}{X}$

or

$$(18) \qquad \frac{P \frac{dX_i}{dL_i} - w}{w} = \frac{\left[\frac{1+\sigma}{N\emptyset}\right] - \left[\frac{1+\sigma}{N\eta}\right]}{1 + \left[\frac{1+\sigma}{N\eta}\right]}$$

Comparing (18) with (7) it can be seen that the effect of incorporating product market power into the analysis is to introduce terms involving the market elasticity of demand, η, into the right-hand side. It is easily verified that as $\eta \to -\infty$ (product market power tends to zero) then (18) $\to$ (7). As we would expect, the presence of product market power increases thesize of the right hand side term and hence increases the proportionate excess of $P \frac{dX_i}{dL_i}$ over the wage rate.[4/]

4. CONCLUSION

Empirical studies of the effect of monopsony power in the labour market on wage rate have lacked an explicit theoretical model relating wages (or the difference between marginal revenue product and wages) and market structure variables. The purpose of this paper was to suggest such a model. It was seen in Section 2 that in terms of our model, the proportional excess of marginal revenue product over the wage rate varies directly with market concentration and "collusion" and inversely with the market elasticity of labour supply. "Collusion" need not depend upon formal agreements among employers but, paradoxically, may be the outcome of close rivalry. In order to focus attention on the labour market the analysis in section 2 assumed that firms faced a fixed product price. This assumption was relaxed in section 3 with the result that the market elasticity of demand emerged as an additional variable to take into account.

One question we have not examined is the possible effect of entry or potential entry. However, whereas there is an extensive literature relating to entry into the product market there has been virtually no analysis of entry into labour markets. This remains therefore an area for future work.

FOOTNOTES

1. See, for example, Gordon (1972), Cain (1976)

2. It is not necessary that the goods be physically identical, as long as they sell for the same price and are produced under identical conditions.

3. See for example Stigler (1964). Stigler's model relates to the product market with price as the decision variable, but the same idea could be applied to quantity competition in the labour market.

4. Note that with a downward sloping demand curve for the product, $P \frac{dX_i}{dL_i}$ is no longer the marginal revenue product of labour.

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