# DEALING WITH MONOPSONY POWER:

# EMPLOYMENT SUBSIDIES vs. MININUM WAGES

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## Abstract

We show in a monopsony model that accounting for changes in hours a minimum wage has ambiguous effects on employment and welfare. When all workers have the same preference ordering over leisure and consumption employment subsidies unambiguously improve welfare. Many countries have minimum wages and also tax minimum wage workers.

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## Section I: Introduction

Manning (2003) has argued for the importance of monopsony power in modern labour markets.[1] Importantly, monopsony models result in inefficient market outcomes that provide a rationale for regulation. Minimum wages tend to be the common policy response while minimum wage workers are often taxed. In this paper we demonstrate that minimum wages may lower employment and welfare in a monopsony model while subsidies rather than taxes are efficient for a common class of utility functions.

## Section II: A Partial Equilibrium Monopsony Model

We assume that workers satisfy the constraints $h=(T-l)$ and $x=E$ where $h$ is hours worked, $T$ is a time endowment, $l$ is leisure, $x$ is consumption and $E$ earnings. Utility is increasing in consumption and leisure and substituting for the above constraints we get the utility function $u[d(h,E),k]$, which we assume is weakly separable in k. This means all workers have the same preference ordering over bundles of E and h and firms cannot discriminate by offering different hours wage packages that different worker types could self select into.[2] Labour supply will be increasing in the wage and decreasing in hours. We assume the utility function is monotonically increasing in k which is distributed over a mass m of workers according to the function F(k). Workers have reservation utility S. For any hours

[1] Manning (2003) p.360 lists the sources of Monopsony power as "Ignorance among workers about labor market opportunities, individual heterogeneity in preferences over jobs and mobility costs".

[2] Bryan (2004) develops a model where the production function depends on total hours and the number of workers. If the source of monopsony is differences in workers preferences over hours with a limited supply of each type, Bryan argues convincingly that we would expect the firm to discriminate, offering different hours packages to each type. A general model incorporating discriminating monopsonists is beyond the scope of this paper, although, as a referee has shown, subsidies will not always increase welfare in models with heterogeneous preferences over leisure.

earnings bundle the firm offers, labour supply is $n(h,E) = mF(k^*)$ where $k^*$ is the value of $k$ where $u[d(h,E),k^*] = S$. The firm is a price taker for output and has the profit function:

$$q_1 p = q_1[G(E,h) - n(E,h)(E + q_2)]. \tag{1}$$

The production function which depends on the number of workers and hours is *G[n(E,h),h]*. There is a a per unit tax/subsidy on workers of $q_2$, and a profits tax rate of $t_1$ where $q_1 = (1 - t_1)$. Totally differentiating the first order conditions from the profit maximisation problem ($p_E = 0, p_h = 0$) we get the impact of the subsidy on hours and earnings (the Hessian determinant is denoted by |H|):

$$\frac{dh}{dq_2} = \frac{p_{Eh}p_{Eq_2} - p_{hq_2}p_{EE}}{|H|} \tag{2}$$

$$\frac{dE}{dq_2} = \frac{p_{Eh}p_{hq_2} - p_{Eq_2}p_{hh}}{|H|} \tag{3}$$

Differentiating the profit function we can calculate (2) and (3) and use these to calculate the impact on labour supply:

$$\frac{dn}{dq_2} = n_h \frac{dh}{dq_2} + n_E \frac{dE}{dq_2} = \tag{4}$$

$$\frac{[G_n - (E + q_2)]\{[n_{EE}n_h - n_{hE}n_E]n_h + [n_{hh}n_E - n_{Eh}n_h]n_E\} + G^*_{hh}n_E^2}{|H|} < 0$$

It is straightforward to show that labour supply is decreasing/increasing in the tax/ subsidy if consumption and leisure are normal goods.[3, 4]

By differentiating the profit function and imposing the first order conditions:

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[3] In the standard neo-classical labour supply problem Consumption and leisure are normal goods if: $u_{hE}u_h - u_{hh}u_E > 0$ and $u_{EE}u_h - u_{Eh}u_E > 0$.

[4] A tax/subsidy may increase or decrease hours per worker and earnings, but it will always lower/raise worker utility.

$\frac{dp}{dq_2} = -n$. Government revenue from profits and the employment tax/subsidy is: $R = t_1 p + q_2 n$. Totally differentiating and imposing the first order conditions from profit maximisation results in:

$$\frac{dR}{dq_2} = -nt_1 + n + \frac{dn}{dq_2} q_2 . \qquad (5)$$

Total surplus, *TS*, generated by this firm is the sum of profits, worker utility ($U = \int_{\underline{k}}^{k^*} u[d(h,E),k] f(k) dk$) and revenue:

$$TS = p + U + R . \qquad (6)$$

From above the change in total surplus from an increase/decrease in the tax/subsidy is:

$$\frac{\partial TS}{\partial q_2} = \frac{\partial p}{\partial q_2} + \frac{\partial R}{\partial q_2} + \frac{\partial U}{\partial q_2} = -nt_1 + \frac{dn}{dq_2} q_2 + \frac{\partial U}{\partial q_2} \qquad (7)$$

Total surplus is increasing if worker utility is increasing as long as $\frac{\partial n}{\partial q_2} \frac{q_2}{n} > t_1$. In particular starting from a point where $q_2 = t_1 = 0$, we see that a small subsidy will increase welfare if U increases, while, given our assumption on the utility function, U is increasing if employment increases. It follows from (4) that a tax/subsidy will lower/raise welfare.

Many monopsony models in the literature could be seen as variants of this model. In Bhaskar and To (1999) k would reflect firm specific preferences, while Burdett and Mortensen (1998) develop an equilibrium search model where firms have upward sloping supply curves.[5] Manning (2003) shows that a firm with convex

[5] In this model a minimum wage will increase employment if there is heterogeneity over workers reservation wages.

turnover costs has an upward sloping labour supply curve. In these models worker utility and labour supply both increase with the wage. In our model we assume that worker utility is monotonically increasing in labour supply n(E,h).[6]

Next we examine the impact of a minimum wage on employment. In this example we impose a specific simple functional form on the grounds that if the impact of a minimum wage is ambiguous in such an example, then the same is true in a general framework. We also look at an hourly wage *w* rather than total earnings.

For each firm F*(k)* is a uniform distribution function, S=*0* and *k* is a fixed disutilty from going to work. For the marginal worker who accepts a job at the offered wage hours combination $u(h,w)=k$. Given the above assumptions, the number of workers is $n(w,h)=u(w,h)=[wh(T-h)]^b$.[7] The elasticity of labour supply with respect to worker utility is *b* where a small *b* indicates a high degree of monopsony power.[8] We also assume $Y=G(n,h)=n^c h^d$, where *c* and *d* reflect the intensity of workers and hours in the production function.[9]

The firm's profit function, where the output price is unity, is:

$$p = n^c h^d - whn = w^{bc} h^{bc+d} (T-h)^{bc} - (T-h)^b (wh)^{b+1}. \qquad (8)$$

From the first order conditions for *h* and *w* one can solve for the optimal solutions:

$$h = T\frac{d(b+1)}{d(b+1)+bc} \text{ and } w = \left[\frac{bch^{d-1+bc-b}(T-h)^{b(c-1)}}{b+1}\right]^{\frac{1}{1+b(1-c)}}. \qquad (9)$$

Differentiating the first order condition on *h* we define the elasticity of hours with

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[6] Hwang et al. (1998) develop a version of the equilibrium search model where labour supply depends on worker utility which depends on wages and working conditions.

[7] The utility function is Cobb-Douglas in consumption (x) and leisure l: $u=(xl)^b$.

[8] We assume that the coefficients on consumption and leisure are equal for simplicity. Not doing so only gives another potential source of ambiguity in terms of the employment effects. De Fraja (1999) shows that the employment effects of a minimum wage are small in a model with heterogeneity in workers preferences over wages and working conditions.

[9] Hamermesh p129 discusses various studies that estimate this model of the labour aggregator.

respect to the wage:

$$e_{hw} = \frac{dh}{dw}\frac{w}{h} = -\frac{p_{hw}}{p_{ww}}\frac{w}{h}. \qquad (10)$$

Given $n(w,h)=u(w,h)= \ u = [(wh)(T-h)]^b$ and using the solution for $h$ given in (9), the elasticity of employment with respect to the minimum wage evaluated at the market wage is:

$$e_{nw} = (n_w + n_h \frac{dh}{dw})\frac{w}{n} = b[1 + (1 - \frac{h}{t-h})\frac{dh}{dw}\frac{w}{h}] = b[1 + (\frac{b(c-d)-d}{bc})e_{hw}] \qquad (11)$$

By differentiating the profit function and using the first order conditions on $w$ and $h$ we can solve for (11):

$$e_{hw} = -\frac{[\frac{bc+d}{h} - \frac{bc}{t-h} - \frac{b+1}{h} + \frac{b}{T-h}]bc}{[\frac{bc+d}{h} - \frac{bc}{t-h} - \frac{b+1}{h} + \frac{b}{T-h}]b(c-d) - d[\frac{1}{h} + \frac{1}{T-h}]} \qquad (12)$$

Using (9) and (12) in (11) we can solve for $e_{nw}$ in terms of the exogenous parameters. The sign of (11) is ambiguous. For our purposes it suffices to show that under reasonable parameter assumptions the sign can be positive or negative, and we experiment in Table 1 with various values for the parameters.[10] Specifically, we assume $d$=0.5 and provide the critical values for $c$, below which $e_{nw}$ is negative, at different values of $b$. If there is a lot of monopsony power ($b$ is small) we see that it is only in sectors where the technology is intensive in hours relative to workers (small $c$) that the above elasticity will be negative.[11] Intuitively, if $c$ is less than $d$ (i.e., hours intensive firms) a firm may substitute from workers to hours in response to the minimum wage to the extent that the decrease in utility from more hours outweighs

[10] A Maple file which can be used to simulate the model and also to verify the solutions above is available from the authors.

[11] We also report the levels of hours, number of workers and wage at the cutoff values for c.

the increase in utility from the higher wage, and thus employment and utility fall.[12, 13] One should also note that opinions on the degree of monopsony power differ. Some of the evidence in Manning(2003), suggests that the elasticity of labour supply with respect to wages may be less than unity while Boal and Ransom (1997) conclude that "Monopsonistic exploitation.., is probably widespread but small on average".

It could be argued that a combination of minimum wages and hours restrictions would be a more effective way of moving to the efficient outcome as in Naylor (2002) for example.[14] While this is also true in the model developed above, there are some important limitations to such a policy combination. Firstly, there are many characteristics other than hours to a job, such as effort, shift length, discipline etc., which can also be varied to the detriment of the worker even if there are regulations on wages and hours. Secondly, part-time workers tend to be over-represented in minimum wage employment and only a fairly small proportion of minimum wage workers work long hours. Thus any reasonable maximum hours restriction would be irrelevant for most minimum wage workers, while minimum hours restrictions would be impractical and costly.

**Section III: Discussion**

The example above illustrates the difficulty in improving labour market outcomes under monopsony using minimum wages. In the empirical literature there is

[12] Hamermesh (1993) summarises several studies that estimate the Cobb-Douglas specification. Some, such as for example Feldstein (1967), argue that the a priori argument that d>c is very strong. Also, Hart and McGregor (1988) find higher elasticities for hours, whereas Leslie and Wise (1980) argue that workers and hours have the same weight in the production function. Also See Barzel (1973) for a model of hourly wage determination.

[13] As a referee noted, from the envelope theorem it follows that a just binding minimum wage leaves profits unchanged. Since utility is incrasing with labour supply it follows that the sign of the change in employment and welfare are the same.

[14] Manning (2003) shows employment increases with a restriction on working conditions in a Monopsony model, a result attributed to De Meza et. Al (1998).

still no consensus on the sign of the employment effect of a minimum wage (see, for example, Neumark and Wascher (2000) and Card and Krueger (2000)). At best the impact appears to be small and positive indicating in a monopsony framework that the policy has little impact on worker utility.

If working conditions or hours do not vary in response to the minimum wage the objections to minimum wages outlined above would not be important. While most studies find a fall in hours per worker in response to a minimum wage, there is some conflicting evidence on the direction of the change. Notwithstanding this almost all studies find considerable variation in hours per worker; see Neumark et al.(2000b), Couch and Wittenberg (2001), Zavodney(2000), or Katz and Krueger (1992) for the U.S., Stewart and Swaffield (2004) or Connolly and Gregory (2002) for the U.K, Nolan et al. (2002) for Ireland, or Strobl and Walsh (2002) for Trinidad and Tobago.

A brief look at the mix of tax minimum wage policies currently in place in some developed economies indicates that the policy recommendations implied by the above analysis are relevant. For the US the current basic tax free exemption and federal minimum wage are $5,150 and $5.15, respectively. Thus, a single worker who works 48 weeks pays tax if they work more than 21.1 hours a week [Neumark et al. (2000b) report average hours of about 30 for workers close to the minimum wage].[15] A policy mix of minimum wages where minimum wage workers pay tax is common. Our analysis suggests that lowering minimum wages and taxes on lower wage workers may be a more efficient way of helping low wage workers.

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[15] Doing a similar calculation using the amount of tax free allowance and minimum wages for UK suggest that those working at least 22 hours would pay tax. Connolly and Gregory (2002) show that 40% of women affected by the U.K. minimum wage are full-time while Irish minimum wage workers are subject to employers and employees social security taxes.

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**Table 1* – Simulations for when** $e_{nw} < 0$

| ***b*** | 1.5 | 3 | 5 | 10 |
|---|---|---|---|---|
| ***c* when *d*=0.5** | 0.10 | 0.23 | 0.3 | 0.37 |
| ***Hours*** | 0.90 | 0.74 | 0.66 | 0.60 |
| ***Workers*** | 0.04 | 0.05 | 0.05 | 0.05 |
| ***Wage*** | 1.19 | 1.95 | 2.48 | 3.05 |
| ***Profit*** | 0.64 | 0.36 | 0.25 | 0.16 |

*The time endowment is set to unity for the simulations. The second order conditions are satisfied at the above parameter values for all values of c between zero and unity. $e_{nw} < 0$ for all values of c less than the critical values in the table and $e_{nw} > 0$ for all values of c above the critical value when c is between zero and one.