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Getting it Right: Employment Subsidy or Minimum Wage? Evidence from Trinidad and Tobago

by

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Getting It Right: Employment Subsidy or Minimum Wage? Evidence from Trinidad and Tobago

by
Eric Strobl and Frank Walsh

Abstract
In monopsony models of the labour market either a minimum wage or an employment subsidy financed by a lump sum tax on profits can achieve the efficient level of employment and output. Incorporating working conditions into a monopsony model where higher wages raise firm labour supply, but less attractive working conditions reduce it, changes these policy implications. Specifically, a minimum wage policy could, in contrast to an employment subsidy, cause working conditions to deteriorate and welfare to fall. Empirical evidence from the Republic of Trinidad and Tobago shows that a minimum wage did appear to cause working conditions to worsen.

Outline
1. Introduction
2. A Partial Equilibrium Monopsony Model
3. A General Equilibrium Model with Free Entry
4. Empirical Evidence on the Impact of Minimum Wages on Working Conditions
5. Conclusion

I. INTRODUCTION

There has been a large literature estimating the employment effects of minimum wages in recent years. While there is still no consensus on the results (see for example Neumark and Wascher (2000) and Card and Krueger (2000)) many of the studies that find insignificant or small positive employment effects appeal to monopsony models as a rationale for their results (Card and Krueger (1995), Dickens et. al (1999). Such monopsony models where minimum wages may increase employment can be rationalised in labour markets by appealing to labour market frictions; see, for example, Burdett and Mortensen (1998) for a search model where the firms labour supply curve slopes upwards, Bhaskar and To (1999) for a model of monopsonistic competition and Manning (1995) or Rebitzer and Taylor (1995) for efficiency wage models where minimum wages can increase employment.

While the monopsony model can certainly rationalise the small or positive employment effects found in some of the empirical minimum wage studies listed above, in this paper we argue that even if a monopsony model is the appropriate model for the labour market then minimum wages may not be the most effective policy to deal with the distortion resulting from monopsony power. Specifically, we show that in a more general and realistic employment contract where not only a wage but also a set of working conditions is specified an employment subsidy is a more effective way of improving welfare than minimum wages, unless the regulator can choose and enforce the appropriate regulated level for wages and all working conditions. This arises because an employment subsidy does not distort the firm's choice between the wage and working conditions, but does lead the firm to choose the optimal level of employment. A subsidy (the size of which depends only on the slope of the labour supply curve) will lead to the efficient outcome. In other words, small or positive employment effects from minimum wages may be consistent with a monopsony model but that does not imply that the minimum wage is the best method for dealing with the distortion created by monopsony power.

The theoretical literature on working conditions and minimum wages has mixed results. Brown (1999) argues in a simple competitive model where efficiency units of labour is the product of employees times effort (working conditions), that the negative

employment effects of minimum wages would be larger than in a model with fixed working conditions if labour demand is inelastic. Larger negative employment effects can occur because firms substitute from workers into higher effort in response to a minimum wage. De Fraja (1999) develops a model with a distribution of workers with different disutilities of effort. Each worker has diminishing marginal product from exerting effort, but the productivity of each worker is unrelated so there is no substitution between effort and workers. In this model a minimum wage just above the market level has negligible employment effects.

Of course, working conditions are in general difficult to measure and there is little direct evidence of changes in working conditions in response to minimum wage changes (see Brown, 1999, for a survey). Examples of potentially affected working conditions include the amount of time workers devote to health and safety standards, how hard they are expected to work or whether they get to work the desired type of hours. Even apart from measurement issues, the lack of evidence on changes in working conditions may arise because the technology or workers preferences are such that it is difficult to substitute between working conditions and the number of workers in which case working conditions would vary little and the theoretical arguments outlined below would not be important. We thus also provide empirical evidence using the case study the islands of Trinidad and Tobago that the implementation of a minimum wage can lead to the deterioration in working conditions. The incidence of involuntary part-time employment acts as a proxy for one important dimension of working conditions; whether the worker is working the desired number of hours. If workers move from a situation where they can choose the number of hours worked optimally, to one where they wish to work longer hours, this represents a deterioration in working conditions.

The paper is organized as follows. In the following section we present our partial equilibrium model and analyse the effects of an employment subsidy and a minimum wage. Section III extends this model to a general equilibrium framework. In Section IV we provide evidence, using the case study of Trinidad and Tobago, that a minimum wage can indeed cause working conditions to deteriorate. Concluding remarks are provided in the final section.

II. A PARTIAL EQULIBRIUM MONOPSONY MODEL

We assume that there are n firms who are price takers for output and have the following profit function[1] which is used to choose the optimal wage and working conditions combination. This combination will determine the number of workers any firm i attracts given the wage/working condition combinations offered by other firms:

$$\Pi = PF(L_i[w^1..w^n, x^1..x^n, n]x^i) - (w^i + \theta)L[w^1..w^n, x^1..x^n, n] - C \qquad \text{(II.1)}$$

The wage and working conditions are w^i and x^i respectively where $L_{w^i} > 0$, $L_{w^i w^i} \leq 0$, $L_{x^i} < 0$ and $L_{x^i x^i} < 0$. Other firms compete for workers where $L^i_n < 0$ $L^i_{w_j} < 0$ and $L^i_{x_j} < 0$ for any other firm j. The product of working conditions (x) times employment (L) is the number of efficiency units of labour (N). P is the output price which is assumed to be constant. There is a per unit tax (subsidy) of θ per worker. C represents fixed costs and n is the number of firms. At this stage we examine partial equilibrium analysis, modelling a given firms behaviour for a fixed n. We will also assume the firms labour supply curve is separable in the variables. Since other firms decisions are taken as given in Nash equilibrium the subscript notation is for now suppressed.

The first order condition for x implies:

$$PF_N(w,x)[L(w,x) + L_x(w,x)x] = (w + \theta)L_x(w,x) \qquad \text{(II.2)}$$

The first order condition for w implies

$$PF_N(w,x)L_w(w,x)x = L + (w + \theta)L_w(w,x) \qquad \text{(II.3)}$$

Together first order conditions imply:

$$PF_N(w,x) = \frac{-L_x}{L_w} \qquad \text{(II.4)}$$

1 The model can be modified to analyse working conditions that do not affect productivity but are costly to improve for the employer with similar results.

It is straightforward to show that if $\theta = -\frac{L^*}{L_w^*}$ (where * denotes the value at the socially optimal outcome) then the first order conditions will satisfy $PF_N x = w$. The wage equals the value of marginal product of the last worker which is the efficient outcome. We define the elasticity of employment with respect to working conditions and wages, respectively, as:

$L_x \frac{x}{L} = \varepsilon$ and $L_w \frac{w}{L} = E$

The first order conditions imply:

$$\frac{PF_N x}{w+\theta} = (\frac{\varepsilon}{1+\varepsilon}) = 1 + \frac{w}{(w+\theta)E} \qquad \text{(II.5)}$$

(II.5) implies that in equilibrium with no taxes or subsidies (θ=0):

$$1 + E = -\varepsilon \qquad \text{(II.6)}$$

If θ<0 then (II.5) implies:

$$1 + E < -\varepsilon \qquad \text{(II.7)}$$

If the optimal subsidy $\theta = -L^*/L_w^*$ is imposed then (II.5) implies that $-E = \varepsilon$ at the efficient outcome. If the first order conditions are satisfied a sufficient condition for the second order conditions, which are derived in the Appendix 1, being satisfied is $\theta \leq 0$.

The expression for the optimal subsidy is the same as we would get in the standard monopsony model with fixed working conditions illustrated in the introduction. The distortion in the model comes from the necessity to offer contracts with higher utility to attract additional workers. A subsidy on employees equal to the difference between the marginal cost of the last worker at the optimal combination of employment and working conditions and the wage at the optimal combination, will achieve the first best outcome. In a fixed working conditions model the subsidy would equal the difference between the marginal cost of the last worker at the optimal level of employment and the wage needed

to secure that level of labour supply.

The Cost of the Optimal Subsidy

We label the level of profit a firm would make if they chose the optimal combination of working conditions and employment the normal profit level, and the excess of profits over this amount as monopsony profits. It is easy to see that if the optimal subsidy is financed by a lump sum tax on profits then the firm will be left at the normal profit level. Profits if the firm chose the optimal outcome (in the absence of a subsidy) would be:

$$\pi^N = PF(x^* L^*) - w^* L^* \tag{II.9}$$

The optimal wage means a wage just high enough to secure the optimal number of workers at the optimal level of working conditions. Since at the optimal subsidy θ the firm chooses this optimal combination the firm's profit with the subsidy is:

$$\pi^S = \pi^N + \theta L^* \tag{II.10}$$

This shows that a lump sum tax of θL^* on profits would raise enough revenue to finance the subsidy and leave the firm with normal profits.

Minimum wages, working conditions and employment with pure monopsony

We shall assume that the firm is in equilibrium choosing working conditions and wages freely and satisfying equations (II.2) and (II.3). If a minimum wage just above that chosen by the firm is imposed we totally differentiate (II.2) to calculate the impact on working conditions (see Manning (1995) for a similar exercise in an efficiency wage model)[2]. :

2 One of Mannings examples the Solow model is the same as the model in above model with no monopsony power. Firms labour supply curve is horizontal at any given wage effort combination. The elasticity of employment with respect to the minimum wage is $\frac{dL}{dw}\frac{w}{L} = -1$. See Brown (1999 P2110) for a similar example. If labour demand is inelastic then incorporating working conditions into the model will accentuate the negative employment effects.

$$\frac{dx}{dw} = -\frac{\pi_{xw}}{\pi_{xx}} > 0 \qquad \text{(II.11)}$$

It is clear from Appendix 1 that (II.11) is positive when the first order conditions hold. The impact on employment L(w,x[w]) of a minimum wage (so that the optimal choice of working conditions now depends on the exogenously determined wage rate) would be

$$\frac{dL}{dw} = L_w + L_x \frac{dx}{dw} \qquad \text{(II.12)}$$

In Appendix 1 (b) we show that if the following condition is met then the employment effect of a minimum wage will be negative:

$$-\frac{L_{xx}\dfrac{x}{L_x}}{F_{NN}\dfrac{N}{F_N}} > L_w \frac{w}{L} \qquad \text{(II.13)}$$

(II.13) implies that if the ratio of the elasticity of the change in labour supply from a change in working conditions relative to the elasticity of the marginal revenue of efficiency units with respect to efficiency units exceeds the labour supply elasticity, the employment effects of the minimum wage will be negative. We see from II.11 that working conditions, which were already below the optimal level will deteriorate further as a result of the minimum wage. The impact on employment is ambiguous. It is difficult to provide a strong argument that II.13 will be either positive or negative. Using minimum wages to regulate labour market outcomes in this model is very much a shot in the dark.

A Minimum Level of Working Conditions, Wages and Employment with Pure Monopsony

Given that the first order conditions hold, if a maximum level of working conditions below the equilibrium level were imposed by totally differentiating (II.3) one can see that the optimal wage would fall in response and employment could increase:

$$-\frac{dw}{dx} = \frac{\pi_{xw}}{\pi_{ww}} < 0 \qquad \text{(II.14)}$$

The impact on employment would be

$$-\frac{dL}{dx} = -L_x - L_w \frac{dw}{dx} \qquad \text{(II.15)}$$

It is shown in Appendix 1 (c) that if the following condition is met then a maximum effort requirement increases employment:

$$L_w \frac{w}{L} > \frac{L_{ww} \dfrac{w}{L_w}}{PF_{NN} \dfrac{N}{F_N}} \qquad \text{(II.16)}$$

If the labour supply elasticity is greater than the ratio of the elasticity of the change in labour supply from a change in wage with respect to a change in the wage over the elasticity of the marginal revenue of efficiency units with respect to efficiency units. So for example if there were a linear labour supply curve (L_{ww}=0) then a restriction on working conditions will increase employment. Once again it is difficult to get a clear picture of the employment and welfare consequences of this policy. Working conditions move closer to the optimal level but employment may rise or fall.

A Simple Example

In this short section we derive the labour supply curve in a very simple example. A mass of μ workers with the following utility function is uniformly distributed along a unit interval:

$$U = w - x^2 \qquad \text{(II.17)}$$

A firm, which is a price taker on the output market lies at one end of the interval. Workers face a transport cost td if they travel to the firm where d is distance and t is the marginal transport costs. Transport costs could be thought of as firm specific preferences as in Bhaskar and To (1999) or some other labour market friction. The firm will have the following labour supply curve:

$$L = \mu(\frac{w - x^2}{t}) \tag{II.18}$$

Equation II.13 in this case becomes:

$$\frac{x^2}{w} - 1 > F_{NN}\frac{N}{F_N} \tag{II.19}$$

Note that if labour supply is positive this condition will not hold with a constant marginal product of efficiency units. It also looks like the condition is more likely to hold the more concave the production function. Solving analytically we set μ and t and equal to unity for simplicity. The change in employment from a change in the minimum wage (evaluated at the unconstrained equilibrium is 0.111 if the production function is $F(N) = N$. If the production function is $F(N) = \ln(N)$ the employment effect is -0.111. In both cases the second order conditions are satisfied and the outcomes are economically plausible (positive wages, working conditions, labour supply and profit). The output price must lie above a threshold level in the second case for profits to be positive. This simple example shows in a simple textbook monopsony model that when working conditions are incorporated into the model the employment effects of minimum wages can be reversed by changing the production function in a simple way.

Welfare Analysis of a Minimum Wage or Restricted Working Conditions Level with Pure Monopsony

Each potential worker has a utility function:

$$util_i = u(x, w) \tag{I.17}$$

Where $u_x < 0$ and $u_w > 0$. Unemployed workers get some reservation level of utility $\bar{u} + d_i$. Each worker i has an individual characteristic d_i. The differing values for d_i are the basis for the upward sloping labour supply curve. In a traditional model of monopsony or oligopsony where firms have power in the local labour market we could think of d_i as representing different reservation wages amongst potential workers. In models where labour market frictions are the source of monopsony power d_i might represent distance to work or preference for a particular employer as in the model outlined in section II. Alternatively it might represent the fact that workers have

different information or search costs. The key point is that a cost minimising firm will hire the cheapest workers first (the workers with the lowest values for d_i. This implies that if a firm wishes to attract an additional worker it must offer a wage and working conditions combination, which raises the utility of it's existing workers, while a firm which lowers employment can lower the utility of its remaining workers. If π is profit per firm, we define the welfare function as:

$$Wf = Wf(\sum_{i=1}^{k} Util_i, \sum_{i=1}^{n} \pi_i) \qquad \text{(II.18)}$$

where welfare is increasing in the utility of any of the k potential workers, or in the profits of any of the n firms.

We can see that if a binding minimum wage or maximum working conditions requirement leads to a fall in employment then welfare must fall. Each firm's profits must be lower since the regulated outcome could have been chosen in the absence of regulation but was not. Each worker who moves to unemployment has lower utility since utility in employment must have been at least as great as the reservation utility. Since the firm is still on the labour supply curve after the regulation, but at a lower level of employment then each employed worker is worse off because when employment falls the firm can offer a contract giving lower utility. If regulation leads to an increase in employment the welfare effects are ambiguous. Firms are worse off and workers are unambiguously better off.

III. A GENERAL EQUILIBRIUM MODEL WITH FREE ENTRY

In this section we model the impact of firm exit/entry in response to the minimum wage or a labour subsidy and analyse a situation where identical firms are in a symmetric Nash equilibrium choosing wages and working conditions freely given conjectures on other firms behaviour. Firm exit leads to an increase in labour supply for existing firms in equilibrium. If minimum wages or other regulations reduce profits exit must occur until profit is restored to its initial level to cover fixed costs.

A Minimum Wage

A minimum wage imposed just above the equilibrium level will have the following impact on the profits of any firm i in the long run:

$$\frac{d\pi^i}{dw} = \pi^i_{w^i} + \pi^i_{x^i}\frac{dx^i}{dw} + \sum_{j\neq i}\pi^i_{w^j} + \sum_{j\neq i}\pi^i_{x^j}\frac{dx^i}{dw} + \pi^i_n\frac{dn}{dw} = 0 \quad \text{(III.1)}$$

The minimum wage will affect the firm's profits through labour supply by increasing its own wage which attracts more workers, but also through the effect of the minimum wage on the optimal choice of working conditions which also determines how many workers are attracted to the firm. In addition the change in other firms' wage and working conditions in response to the minimum wage impact on the firms labour supply and profits. In the long run firm exit will ensure that the total impact on profits is zero and fixed costs can be covered. Since we start at initial equilibrium where the firm is optimising we invoke the envelope theorem to set the first two term equal to zero so that:

$$\frac{d\pi^i}{dw} = \sum_{j\neq i}\pi^i_{w^j} + \sum_{j\neq i}\pi^i_{x^j}\frac{dx^i}{dw} + \pi^i_n\frac{dn}{dw} = 0 \quad \text{(III.2)}$$

We can take the partial derivatives in (III.2) from equation (II.1) to get:

$$\sum_{j\neq i}\pi^i_{w_j} = \sum_{j\neq i}(PF_N x^i - w^i)L^i_{w^j} \quad \text{(III.3)}$$

$$\sum_{j\neq i}\pi^i_{x_j} = \sum_{j\neq i}(PF_N x^i - w^i)L^i_{x^j} \quad \text{(III.4)}$$

$$\pi^i_n = (PF_N x^i - w^i)L^i_n \quad \text{(III.5)}$$

Using these derivatives in (III.2) and dividing out the constant we rewrite (III.2) as:

$$\frac{d\pi^i}{dw} = \sum_{j\neq i}L^i_{w^j} + \sum_{j\neq i}L^i_{x^j}\frac{dx^j}{dw} + L^i_n\frac{dn}{dw} = 0 \quad \text{(III.6)}$$

Which in turn implies:

$$-L^i_n\frac{dn}{dw} = \sum_{j\neq i}L^i_{w^j} + \sum_{j\neq i}L^i_{x^j}\frac{dx^i}{dw} \quad \text{(III.7)}$$

The right hand side of (III.7) constitutes the impact on a firm's profit resulting from the minimum wage which affects firm labour supply by changing other firms' wage and effort. An unusual feature of the model is that a minimum wage could initially increase profits if employment in each firm falls. That is, if the minimum wage leads to a big deterioration in working conditions then employment in each firm could fall. Each firm would face less stiff competition from other firms, which would lead to an outward shift in each firm's labour supply and an initial profit increase. A minimum wage would increase entry in this case.

Initially we will examine the impact of the minimum wage on employment in an individual firm, accounting for the impact of firm exit on employment within the firm. Differentiating the firms labour supply function with respect to wages we get

$$\frac{dL^i}{dw^i}(\sum_{j=1}^{n} w^j, \sum_{j=1}^{n} x^j, n) = \sum_{j=1}^{n} L^i_{w^j} + \sum_{j=1}^{n} L^i_{x^j} \frac{dx^j}{dw} + L^i_n \frac{dn}{dw} = L^i_{w^i} + L^i_{x^i} \frac{dx^i}{dw} \qquad \text{(III.8)}$$

Using (III.7) in (III.8) we get the result that the positive impact on firm labour supply of firm exit is offset exactly by the impact on firm labour supply of changes in other firms' wages and working conditions. The impact on an individual firm's labour supply is the same under partial and general equilibrium analysis. Aggregate employment is the product of the number of firms times employment:

$$E = nL(w^i, x^i, w^j, x^j, n) \qquad \text{(III.9)}$$

Differentiating with respect to the wage and using (III.7) and (III.8) we get:

$$\frac{dE}{dw} = \frac{dL}{dw} n + \frac{dn}{dw} L = \frac{dL}{dw} n - (\sum_{j \neq i} L_{w^j} + \sum_{j \neq i} L_{x^j} x^j_w) \frac{L}{L_n} \qquad \text{(III.10)}$$

Imposing symmetry for wages and working conditions on firms where an i superscript denotes the firm and j the other firms and where for example ε_{w^i} denotes the labour supply elasticity of a firm with respect to its own wage and ε_{xw} denotes the percentage

change in x from a percentage change in w. Using this notation (II.10) implies that the percentage change in industry employment from the minimum wage is:

$$\varepsilon_{Ew} = \varepsilon_{w^i} + \varepsilon_{x^i}\varepsilon_{xw} - \frac{\sum_{j\neq i}[\varepsilon_{w^j} + \varepsilon_{x^j}\varepsilon_{xw}]}{\varepsilon_n} \qquad \text{(II.11)}$$

Where ε_n is the elasticity of a firm's labour supply with respect to the number of firms, which is negative. We see from II.11 that modelling firm entry leads to the same ambiguity we got in the partial equilibrium framework. It would be difficult for policy makers to predict the employment and welfare consequences of minimum wages.

An employment subsidy:

The analysis of the employment subsidy with firm entry is very similar to analysis of the minimum wage. Adapting equation (II.1) the impact on firm profits is:

$$\frac{d\pi^i}{d\theta} = \pi^i_{w^i}\frac{dw^i}{d\theta} + \pi^i_{x^i}\frac{dx^i}{d\theta} + \sum_{j\neq i}\pi^i_{w^j}\frac{dw^j}{d\theta} + \sum_{j\neq i}\pi^i_{x^j}\frac{dx^i}{d\theta} + \pi^i_n\frac{dn}{d\theta} + \pi^i_\theta = 0 \qquad \text{(III.12)}$$

Note that the employment subsidy is financed by a lump sum tax on profit. The derivative of the lump sum tax with respect to the subsidy is L_i which will cancel out with the final term in (II.12). As in the previous subsection we apply the envelope condition to set the first terms equal to zero and use the first order conditions to rewrite the remaining terms as functions of labour supply:

$$\frac{d\pi^i}{d\theta} = \sum_{j\neq i} L^i_{w^j}\frac{dw^j}{d\theta} + \sum_{j\neq i} L^i_{x^j}\frac{dx^j}{d\theta} + L^i_n\frac{dn}{d\theta} = 0 \qquad \text{(III.13)}$$

As in the previous subsection we use (II.8) and (II.9) with (II.13) to get the percentage change in industry employment from a percentage change in the subsidy (accompanied by a self financing increase in the lump sum tax):

$$\varepsilon_{E\theta} = \varepsilon_{w^i}\varepsilon_{w\theta} + \varepsilon_{x^i}\varepsilon_{x\theta} - \frac{\sum_{j\neq i}[\varepsilon_{w^j}\varepsilon_{w\theta} + \varepsilon_{x^j}\varepsilon_{x\theta}]}{\varepsilon_n} \qquad \text{(II.14)}$$

An attractive feature of II.11 and II.14 is that they depend only on the firms labour supply curve.

Monopsony in the Product Market

Finally one should also note that the model developed above for the labour market can be thought of as a generic monopsony model where firms have market power over input suppliers. The wage is the price of the input, working conditions is the quality of the input and the utility function of workers can be thought of as the profit function of input suppliers. Input suppliers face different transport costs to different firms. These costs may be actual transport costs or act as a proxy for any logistical advantage that makes it easier for an input supplier to supply to a particular firm. The results indicate that while output and the input price will be too low in a market equilibrium while quality will be too high. That is, the monopsonist will be able to enforce undue restrictions on input suppliers. Regulating price may lower welfare in the absence of regulations on quality. A welfare reduction might result from regulations on quality in the absence of regulations on price. A per unit subsidy on the input achieves the socially desirable outcome.

IV. EMPIRICAL EVIDENCE ON THE IMPACT OF MINIMUM WAGES ON WORKING CONDITIONS

The implicit assumption in using our model to argue that an employment subsidy would be preferred to a minimum wage to increase employment under monopoly power is that employers are able to substitute working conditions and employment. In his survey of the minimum wage literature Brown (1999) states that "while I find it hard to believe that employers do not respond to minimum wage increases by raising standards of effort, punctuality etc. Evidence on the scale of such adjustments is sadly lacking; but if they are important, they are likely to intensify rather than resolve the puzzle of the small employment elasticities" (p. 2157). Part of the reason for this lack of evidence is that working conditions are not only difficult to measure, but that is rather difficult to identify and isolate situations and corresponding data where minimum wages could have potentially affected working conditions. In this section, using the case study of the

Republic of Trinidad and Tobago, we provide evidence that minimum wages can indeed affect working conditions. Since either competitive or monopsony models of the labour market employers can demand more stringent working conditions of the employee when the minimum wage is imposed, the empirical analysis of this section does not distinguish between these two types of models. Rather it is an attempt to deal with the concern expressed by Brown (1999) above that there is little direct evidence on the degree that minimum wages effect can affect other outcomes of employment such as working conditions.

Working conditions, of course, can pertain to a large number of characteristics of a job. One important feature of a job in terms of its affect on worker utility, and the one we focus on in our analysis, for how many hours employees have to work. As in standard neo-classical labour supply, workers preferences would determine the wage needed to induce workers to work different numbers of hours etc. We could reasonably conjecture that employers also have strong preferences over how long they would like their employees to work. Interaction between workers and firms would lead to an equilibrium level of employment, hours and other characteristics. If we observe an increase in the likelihood that workers will be working less than desired in response to minimum wage increases, this can be taken as evidence of a deterioration in working conditions. Firms pay a wage greater than the equilibrium wage but insist on less than the desired number of hours worked per worker.

A small number of studies have examined the impact of minimum wages on the workers' hours. Brown's (1999: 2117) conclusion is that "limited evidence suggests that the minimum wage reduces hours worked by employed teenage workers". Couch and Wittenberg (2001) use the U.S. current population survey to construct state level data by month from 1972-92 and find that changes in the minimum wage led to significant reductions in average hours worked for teenagers. A well known empirical study on the impact of minimum wages on employment and other outcomes is detailed in Card and Krueger (1995). This focussed on an increase in the state minimum wage in New Jersey from $4.25 to $5.05 an hour, which took place on April the first, 1992. The impact on employment in fast food outlets was measured using counties from eastern Pennsylvania where the minimum wage remained unchanged as a control. The evidence on hours worked from this and a series of related studies by the same authors and by Neumark and Wascher was that there was weak evidence of a positive impact on hours work from

the minimum wage change. It should be noted though that neither of these studies distinguish between situations where the change in hours was desired or undesired change, and hence whether they simply are movements along a worker's supply curve[3].

Events in the Republic of Trinidad and Tobago provide us with a natural case study with which to examine the effects of the minimum wage on the labour market. In April of 1998 the Trinidad and Tobago government introduced a national minimum wage for the first time[4][5], setting the minimum wage at the rate of $TT7.00 per hour, regardless of the characteristics of the worker or the nature of work involved. Of course, one of the problems with assessing the impact of minimum wages on the labour market in developing countries is that if compliance is low due to weak regulatory structures, in essence minimum wages can be ineffectual. However, as shown by Strobl and Walsh (2001), although there was a large degree of non-compliance in Trinidad and Tobago, the national minimum wage did push up the wage rate of some workers to the minimum wage rate, while others consequently lost their job.

In order to examine how this national minimum wage may have affected working conditions in Trinidad and Tobago we, as in Strobl and Walsh (2001) utilize the Trinidad and Tobago Continuous Sample Survey of Population (CSSP). The CSSP is a quarterly multi-purpose household survey with its primary objective being to provide up-to-date data on the labour force characteristics of the population of Trinidad and Tobago on a continuing basis, for which we have access to the 1996-98 CSSP surveys. Moreover, it is a rotational survey in that households are surveyed three times – a year after the first interview and a last time the quarter subsequent to the second interview.[6] This latter aspect allows us to create short panels for a significant number of

3 Regressions we carried out on hours work from the current population survey for New Jersey and Pennsylvania indicate that hours fell for minimum wage worker and that involuntary part-time status became more likely for teenagers.

4 While the legislative framework enabling the introduction of minimum wages in Trinidad and Tobago was first passed in 1976, only very few sectoral minimum wages were introduced until 1998, most of which were well below the 1998 level and in practise not strictly enforced; see Strobl and Walsh (2001).

5 The minimum wage rate was implemented in response to recommendations from a 1995 World Bank report on poverty in Trinidad and Tobago and was largely unanticipated by the public and, hence, can be considered a largely exogenous change; see Strobl and Walsh (2001) for details.

6 For a more extensive description of this data set see Strobl and Walsh (2001).

individuals.[7] For all calculations in the present paper we use information on the first two observations, i.e., those which lie a year apart, of the continuously employed, but exclude the self-employed and those working in the government sector.

Apart from information on earnings, hours worked, human capital and working place characteristics, the CSSP most importantly for the purpose here also provides information on the reasons why individuals worked part-time (defined as working less than 33 hours per week). Specifically, one is able to distinguish between the voluntarily and involuntarily part-time employed, where we assume that involuntary part-time employment is utility decreasing working condition.[8] In comparing whether the incidence of involuntary part-time employment increased due to the minimum wage it is of course important to choose the correct study and comparison groups. This becomes somewhat more complicated in a developing country relative to developed countries given the possibility of non-compliance. Normally, i.e. under complete compliance, the natural study group would simply be those workers whose first wage observation is below $TT 7.00 (in appropriate 1998 prices) and occurs before the minimum wage, but whose second observation falls at some point thereafter. When there is the possibility of non-compliance, however, only those whose second observation is actually at least at the minimum level can be considered to be affected, and it is this sub-group that serves as our study group. As a control group we use those individuals whose first observation is below the minimum level and whose second observation falls before the introduction of the minimum wage. Examining the yearly wage distributions for the same sample as here, Strobl and Walsh (2001) show that the only apparent shift in the wage distribution seems to have occurred after the implementation of the minimum wage.[9] However, for further verification that any changes in working conditions are not due to other factors

7 Given the CSSP's close parallel in structure to the US CPS, we used a similar algorithm to that proposed by Madrian and Lefgren (1999) to link individuals over time. This involves using questionnaire, household and time invariant individuals information to link individuals and then using age and its anticipated possible range of changes over time to double check the merges. This allowed us to link 64,700 individuals, of which about 46,000 were of working age.

8 Persons working less than 33 hours are asked to choose among a number of reasons, namely (a) no more work available, (b) new job, (c) illness, (d) temporary layoff, (e) own choice, (f) vacation, and (g) other. Using this information we classified part-time workers as involuntary if they stated either (a), (b), or (d) as reasons.

9 One might be inclined to also use the non-compliant workers as a control group. However, there clearly could be spillover effects from the compliant sector, so that these are unlikely to be a good control group. For instance, for Ghana Jones (1998) shows that were spillover effects in the informal sector due to changes in the minimum wage that affected the formal sector.

that may have coincided with the minimum wage, we also use non-compliant workers as a secondary study group. Hence a high degree of non-compliance is not necessarily a disadvantage in terms of what we are trying to measure here, but rather provides us with another control group to check the robustness of our results.

In order to assess how the introduction of the minimum wage may have altered working conditions in terms of involuntary part-time employment we ran a simple probit model on the incidence of involuntary part-time employment controlling for highest educational attainment, gender, age and its value squared, occupation, industry, employer size, region, the initial wage rate, and year and seasonal effects, where our study and control group are as just stated. Finally, in order to assess the impact of compliance to the minimum wage on the incidence of involuntary part-time work, we included a simple dummy variable for whether an individual's second observation fell after the introduction of the minimum wage. One should note since the time between the actual implementation and when the second observation occurred differs for individuals, from anywhere between one day up to nine months, we are implicitly assuming that the impact was the same regardless of time elapsed.

Our results for this exercise are given in Table 1, where the coefficients are reported as marginal effects. As can be seen, only a few factors help to predict who is more likely to become involuntarily part-time employed. Specifically, workers who work in large firms and workers who receive higher (initial) wages, possibly indicative of higher ability or higher tenure[10], are less likely to experience involuntary part-time employment. Most importantly, we find that, after controlling for other factors, for workers who experienced compliance the introduction of the minimum wage also significantly increased the probability of a person becoming involuntarily part-time employed. In order to confirm that this is not due to other changes occurring at the same time of the minimum wage, we also used those workers who second observation fell after implementation but who were not subjected to compliance in the second column of Table 2. Accordingly, for this group, although the results on the other variables are similar, we do not find a similar effect of the minimum wage - the coefficient on this zero-one dummy is decisively insignificant.

10 Unfortunately the CSSP does not collect information on an employed person's tenure.

V. CONCLUSION

In this paper we argue that employment subsidies financed by taxes on profits are more effective than minimum wages (or regulations in working conditions) in dealing with the distortion caused by monopsony power. The source of the distortion in a monopsony model is the difficulty a firm has in attracting a higher number of workers. An employment subsidy deals directly with the distortion and can lead to the first best outcome. If the employment contract depends on wages and working conditions the government must be confident in its ability to set and enforce all of these variables appropriately to improve welfare. The optimal subsidy on the other hand depends only on the slope of the firms labour supply curve. The cost of the subsidy could be recouped from a tax on monopsony profits.

Boal and Ransom (1997) conclude that Monopsony power is not quantitatively important in terms of its affect on wages. The model presented here raises the possibility that monopsony power could be more important quantitatively than had been thought. A firm with monopsony power might pay only slightly lower wages but will offer less favourable working conditions. We provide empirical evidence for the case of Republic of Trinidad and Tobago, where a national minimum wage was introduced for the fist time, that working conditions, at least measured working less than the desired number of hours, may be important empirically. Considering wages alone could thus understate the drop in workers utility relative to non-monopsony firms.

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Appendix 1.

(a) Second order conditions

The second order conditions for the firms problem are:

$$\pi_{xx} = PF_{NN}[L + L_x x]^2 + (PF_N x - w^s)L_{xx} + 2PF_N L_x \quad \text{(A.1.1)}$$

Note $w^s = w + \theta$

$$\pi_{ww} = PF_{NN}[L_w x]^2 + (PF_N x - w^s)L_{ww} - 2L_w \quad \text{(A.1.2)}$$

We see that for a firm satisfying the first order conditions and if $L_{ww} \leq 0$ and $L_{xx} \leq 0$, then the above derivatives will be negative.

The cross partial derivative is:

$$\pi_{xw} = PF_{NN}[L_w x][L + L_x x] + (PF_N - w^s)L_{xw} + PF_N L_w - L_x \quad \text{(A.1.3)}$$

If we assume separability between effort and wages in the labour supply function this equation simplifies to.

$$\pi_{xw} = PF_{NN}[L_w x][L + L_x x] + PF_N L_w - L_x \quad \text{(A.1.4)}$$

We also note at this stage that if the first order conditions hold then $[L + L_x x] < 0$.

Finally the determinant of the Hessian matrix ($\pi_{ww}\pi_{xx} - \pi_{xw}^2$) is

$$|H| = P^2 F_{NN}^2 [L + L_x x]^2 (L_w x)^2 + [(PF_N x - w^s) L_{ww} - 2L_w] PF_{NN} [L + L_x x]^2 +$$
$$(PF_N x - w^s) L_{xx} [PF_{NN} (L_w x)^2 + (PF_N x - w^s) L_{ww} - 2L_w]$$
$$+ 2PF_N L_x [PF_{NN} (L_w x)^2 + (PF_N x - w^s) L_{ww} - 2L_w]$$
$$- P^2 F_{NN}^2 [L + L_x x]^2 (L_w x)^2 - 2PF_{NN} L_w x [L + L_x x][PF_N L_w - L_x]$$
$$+ (1+s) PF_N L_w L_x - F_N^2 L_w^2 + L_x^2$$

(A.1.5)

After we cancel out terms this becomes.

$$|H| = [(PF_N x - w^s) L_{ww} - 2L_w] PF_{NN} [L + L_x x]^2 +$$
$$(PF_N x - w^s) L_{xx} [PF_{NN} (L_w x)^2 + (PF_N x - w^s) L_{ww} - 2L_w]$$
$$+ PF_N L_x [2PF_{NN} (L_w x)^2 + 2(PF_N x - w^s) L_{ww} - 2L_w]$$
$$- 2PF_{NN} L_w x [L + L_x x][PF_N L_w - L_x] - P^2 F_N^2 L_w^2 + L_x^2$$

(A.1.6)

We can verify easily that as long as the firm is satisfying the first order conditions and the following conditions hold: $L_x < 0$, $L_{xx} < 0$, $L_w > 0$, $L_{ww} < 0$ and $F_{NN} < 0$ then all terms on the first three lines of (A.1.6) are unambiguously positive. Using equation (I.4) we see the second term on the last line can be rewritten: $(PF_N)^2 L_w^2 = -L_x^2$ so that the last two terms on the last line cancel. The only ambiguity in (A.1.6) comes from the first term on the last line which is negative. We will show that this term is dominated by positive terms in the Hessian for the case when $\theta < 0$. I show in the paper that these values for the tax variable will give the first best outcome. As long as the subsidy is not too big (A.1.6) will be positive.

Using the result from the first order condition that $PF_n = -\frac{L_x}{L_w}$ the first term on the last line of (A.1.6) can be rewritten:

$$-2PF_{NN} L_w x [L + L_x x][PF_N L_w - L_x] = 4PF_{NN} L_w x L_x (L + L_x) \quad \text{(A.1.7)}$$

Using the fact that $PF_n = -\frac{L_x}{L_w}$ again the first term on the second last line can be rewritten as:

$$2PF_N L_x[PF_{NN}(L_w x)^2 = -2PF_{NN} L_w x L_x L_x x \qquad \text{(A.1.8)}$$

The last term on the first line can be rewritten as:

$$-2L_w PF_{NN}[L + L_x x]^2 = -2L_w PF_{NN} L_w x L_x \frac{(L + L_x x)^2}{x L_x} \qquad \text{(A.1.9)}$$

If we add the right hand side of (A.1.7) to (A.1.9) and the sum is positive we know the determinant is positive and we are at a maximum:

$$4(L + L_x x) - 2L_x x - 2\frac{(L + L_x x)^2}{x L_x} > 0 \qquad \text{(A.1.10)}$$

Dividing across by $(L + L_x x)$ (which we can see from the first order conditions is negative) (A.1.10) can be rewritten as:

$$4 - 2\frac{1}{1 + \frac{1}{\varepsilon}} - 2(1 + \frac{1}{\varepsilon}) < 0 \qquad \text{(A.1.11)}$$

If $-\varepsilon > 1$ the condition in (A.1.11) is unambiguously satisfied. From the first order conditions in section II. we can show that

$$\frac{PF_N x}{w + \theta} = (\frac{\varepsilon}{1 + \varepsilon}) = 1 + \frac{ws}{(w + \theta)E}$$

(A.1.12)

(A.1.12) implies that in equilibrium with no taxes or subsidies:

$1 + E = -\varepsilon$

If θ<0 then (A.1.12) implies:

$$1 + E < -\varepsilon$$

In either case inequality (A.1.11) is satisfied and we are at a maximum.

(b) Employment effect of a minimum wage

Using equations (I.14) and (I.15) we see that the employment effect of a minimum wage will be negative if the following condition is met:

$$-\frac{L_x}{L_w}\frac{dx}{dw} = \frac{L_x}{L_w}\frac{\pi_{xw}}{\pi_{xx}} > 1 \qquad \text{(A.1.13)}$$

Using the fact that $PF_n = -\frac{L_x}{L_w}$ from the first order conditions and equations (A.1.1) and (A.1.3), inequality (A.1.13) can be rewritten:

$$\frac{PF_{NN} L_x X[L + L_x x] - 2L_x^2 / L_w}{PF_{NN}[L + L_x X][L + L_x x] + (PF_N x - w^s) L_{xx} - 2L_x^2 / L_w} > 1 \qquad \text{(A.1.14)}$$

We see that all terms in the numerator and denominator are negative. The numerator is a bigger negative number than the denominator if the following term is positive:

$$PF_{NN} L[L + L_x x] + (PF_N x - w^s) L_{xx} > 0 \qquad \text{(A.1.15)}$$

If (A.1.15) is positive inequality (A.1.13) holds. Using the first order conditions in (A.1.15)

$$L[L + L_x x] = -w^s L_w L \quad \text{and} \quad (PF_N x - w^s) = \frac{L}{L_w} \qquad \text{(A.1.16)}$$

If inequality (A.1.14) holds a minimum wage slightly above the market level will reduce employment, that is if:

$$\frac{L_{xx}}{L_w} > PF_{NN} w L_w \qquad \text{(A.1.17)}$$

Multiply both sides of (A.1.17) by x, multiply and divide the right hand side by L and the left hand side by L_x and use the fact that $PF_n = -\frac{L_x}{L_w}$ to rewrite the above condition as:

$$-\frac{L_{xx}\dfrac{x}{L_x}}{F_{NN}\dfrac{N}{F_N}} > L_w\frac{w}{L} \quad \text{(A.1.18)}$$

(c) Employment effects of a maximum working conditions requirement

Using equations (I.14) and (I.15) we see that a maximum working conditions requirement will increase employment if the following condition holds:

$$\frac{L_w}{L_x}\frac{\pi_{xw}}{\pi_{ww}} > 1 \quad \text{(A.1.19)}$$

Using (A.1.2), (A.1.4) and the fact that $PF_n = -\frac{L_x}{L_w}$ (A.1.19) can be written as:

$$\frac{PF_{NN}L_w^2 x[L/L_x + x] - 2L_w}{PF_{NN}L_w^2 x[x] + (PF_N x - w)L_{ww} - 2L_w} > 1 \quad \text{(A.1.20)}$$

All terms in the numerator and denominator are non-positive. We see that if the following inequality holds then inequality (A.1.20) also holds:

$-PF_{NN}L_w^2 x\frac{L}{L_x} - (PF_N x - w)L_{ww} > 0$ Using the first order conditions again this can be rewritten as:

$$L_w\frac{w}{L} > \frac{L_{ww}\dfrac{w}{L_w}}{PF_{NN}\dfrac{N}{F_N}} \quad \text{(A.1.21)}$$

Table 1: The Impact of the Minimum Wage on the Incidence of Involuntary Part-Time Employment in Trinidad and Tobago

	(1)	(2)
MINIMUM WAGE	0.062**	0.036
	(0.041)	(0.032)
AGE	-0.003	-0.001
	(0.004)	(0.003)
AGE2	0.000	0.000
	(0.000)	(0.000)
MARITAL STATUS	0.019	0.015
	(0.022)	(0.021)
PRIMARY EDUCATION	0.008	-0.004
	(0.018)	(0.016)
SECONDARY EDUCATION	0.007	-0.013
	(0.024)	(0.018)
URBAN	0.003	-0.002
	(0.014)	(0.014)
EMPLOYER SIZE	-0.026*	-0.030**
	(0.016)	(0.015)
Log(INITIAL WAGE)	-0.011**	-0.011**
	(0.006)	(0.005)
Observations	659	697
Test	49.85***	56.58***
PSEUDO R2	0.17	0.18

Notes: (1) Coefficients reported as marginal effects.
(2) ***, **, and * signify 1, 5, and 10 per cent significance levels.
(3) Includes 1998 year dummy, seasonal dummies, and one digit occupational and industry dummies.
(4) PRIMARY EDUCATION and SECONDARY EDUCATION are highest educational attainment dummies, MARITAL STATUS is a martial status dummy, URBAN is an urban workplace dummy, EMPLOYER SIZE is a dummy for whether employer has at least ten employees and MINIMUM WAGE is a dummy indicating whether the worker was affected by the minimum wage.

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Adam Blake – CGE models of low-income countries
Mike Bleaney - growth, international macroeconomics
Indraneel Dasgupta – development theory, household bargaining
Norman Gemmell – growth and public sector issues
Ken Ingersent - agricultural trade
Tim Lloyd – agricultural commodity markets
Paula Lorgelly – health, gender and growth
Andrew McKay - poverty, peasant households, agriculture
Chris Milner - trade and development
Wyn Morgan - futures markets, commodity markets
Christophe Muller – poverty, household panel econometrics
Tony Rayner - agricultural policy and trade

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David Fielding *(University of Leicester)* – investment, monetary and fiscal policy
Ravi Kanbur (*Cornell*) – inequality, public goods – Visiting Research Fellow
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Stephen Knowles *(University of Otago)* – inequality and growth
Sam Laird (*UNCTAD*) – trade policy, WTO
Robert Lensink *(University of Groningen)* – aid, investment, macroeconomics
Scott McDonald *(University of Sheffield)* – CGE modelling, agriculture
Mark McGillivray *(RMIT University)* – aid allocation, aid policy
Doug Nelson *(Tulane University)* - political economy of trade
Shelton Nicholls *(University of West Indies)* – trade, integration
David Sapsford *(University of Lancaster)* - commodity prices
Eric Strobl *(University College Dublin)* – labour markets
Finn Tarp *(University of Copenhagen)* – aid, CGE modelling
Howard White *(IDS)* – aid, poverty