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Rethinking Labor Supply: Contract Theory and Unions

by

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Abstract

This paper suggests a new approach to the economics of labour supply. Conventional econometric studies conclude, with rare exceptions, that the response of men's hours to increases in wages is small and negative. Yet policy-makers in many countries have argued that incentive effects are large and have set low marginal tax rates accordingly. The evidence in this paper, from a sample of more than twenty-three thousand UK male employees, suggests that, for non-unionized labour markets, the labour supply wage elasticity is considerably large than the existing literature has suggested. The UK offers an unusually valuable test-bed for male labour supply modelling because it has a simple flat rate tax across the majority of the income distribution and offers two natural experiments that circumvent the simultaneity problems that have dogged the literature.

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1 Introduction

Labor supply theory lies at the heart of modern theories of macroeconomics and is a key element in the design of microeconomic tax policy. The traditional analysis of labor supply assumes that hours of work are chosen by the individual employee, and most textbook treatments feature a labor supply curve that is an increasing function of the wage. This idea has permeated the policy arena where it has been seized upon by politicians who, to support their "supply side" reforms, claim that the disincentive effect of high tax rates is strong. Indeed, during the 1980's, many industrialized countries cut marginal tax rates to stimulate the incentive to work.

Paradoxically, there is little econometric evidence to support the view that changes in marginal wage rates have an important effect upon men's hours of work. For the USA and Britain, Pencavel's (1986) survey reveals that the majority of studies find a small *negative* association between wages and hours worked[1]. In some instances, as a recent review by Heckman (1993) notes, even the utility-compensated wage elasticity of hours has the wrong sign to be consistent with conventional theory. Although the work discussed in Hausman (1986) does find evidence that compensated increases in the wage raise male hours of work, Blundell (1992) and MaCurdy (1992) have pointed out that the estimation methods force this to be a feature of the estimates. Hence that particular work does not constitute a test of the theory. It is difficult to resist the conclusion that the econometrician's computer output is directly inconsistent with the politician's priors.

The econometric inadequacies of the canonical model of labor supply have led to a number of recent attempts to extend it. For example, Ham (1986), Blundell, Ham and Meghir (1987), van Soest, Woittiez and Kapetyn (1991), Dickens and Lundberg (1993), and

1 One might argue that incentive effects manifest themselves in other dimensions of labor supply. Unfortunately, there is very little literature on the impact of wages on other dimensions of labor supply.

Moffitt (1982) allow for the possibility that, for demand-side reasons, individuals are off their desired labor supply curves. It may be that these methods will eventually reconcile the current divergence between theory and estimation, but it seems reasonable to argue that they have not yet done so.

This paper begins from two points that have been recognized in the literature but have not been treated carefully. First, large numbers of people work in jobs where the length of the working week is outside their own control. These individuals, when they accept a job, agree to a utility package that specifies a rate of pay and specific conditions of work where the latter include the number of hours to be worked. Thus, conventional theory only applies if individuals choose an overtime level that equates the overtime wage with the marginal disutility of hours, or if individuals choose among a continuum of jobs in such a way that their job choice corresponds exactly to the tangency condition of conventional theory. Although these two possibilities may hold in the real world, they have rarely been examined in the literature. The assumption that individuals can freely vary their hours seems especially inappropriate in large unionized workplaces where hours are fixed by intermittent negotiation. Second, as the survey by Pencavel (1986) makes clear, the potential endogeneity of the wage causes difficulties for the econometrician. One way to circumvent these is to adopt a highly structured model, using information about the kinks in the budget constraint induced by the tax schedule, and to estimate the utility parameters under a set of maintained hypotheses. The results of this kind of exercise tend to be fragile. A second method is to find suitable instruments for the wage. Because there are usually no natural exclusion restrictions, this leads to a variety of *ad hoc* instrumenting assumptions. A related issue is that of measurement error. Most published work calculates the wage by dividing earnings by hours, and this is known to induce a spurious negative correlation between hours and wages. Mroz (1987) demonstrates these estimation problems using a sample of US women. Even if a good instrument for the *gross* wage could be found, that would not imply the end of the

simultaneity problem. Most countries have relatively complicated non-linear tax systems where the marginal tax rate is itself a function of income, which implies that the net marginal wage is endogenous.

The paper addresses these two issues. It constructs a labor contract model in which hours and wages are determined as the result of an efficient bargain[2]. This model can easily generate a *downward-sloping* locus in wage-hours space, so that high wages are then associated with low hours. The model's structure is quite different from the canonical labor supply framework. In the empirical part of this paper it is argued that it is necessary to treat unionized and non-unionized sectors separately. The former should be analyzed with a contract model, and the latter with the canonical model.

The United Kingdom offers, by chance, two important advantages for estimating labor supply models. The first is that the tax system, over the period considered here, was characterised by a flat tax rate that covered such a broad band of income that virtually every worker in the sample paid tax at this standard flat rate (plus social security contributions). Thus, the data are essentially immune from tax-induced endogeneity of the marginal net wage. The second feature is that in 1947 and again in 1973 the British government raised the minimum high-school leaving age, which raised the education level and (it can be shown) the wages of a cohort in an exogenous way. This natural experiment provides one way to instrument the wage in an hours equation and it seems likely to be appropriate for those observations where hours are determined by the canonical model.

The paper uses a second instrument. Wage contracts in Britain are un-indexed and annual (the three year contracts and cost-of-living adjustment clauses common in the US are almost unheard of in the Britain) and our pooled cross-sections of data provide monthly

2 There is relatively little emphasis given to the importance of long term contracts in labor supply and attention was drawn to this in Rosen (1985). An important exception is Abowd and Card (1987).

observations on wages and price. Hence movements in the nominal consumer price index induce movements in the real wage rate from month to month. Because the nominal price level should enter a labor supply function, in any neoclassical analysis, only as the denominator in the real wage, this means that the nominal price level can be used as an instrument for the wage in a labor supply equation[3]. This seems an appropriate form of instrumenting where hours are determined by bargaining between union and employer because it is in that sector where fixed nominal contracts are known to exist.

Section 2 outlines the theoretical framework for a contract model. It demonstrates that there can be a negative relationship between the level of hours of work and the wage rate per hour. Section 3 summarizes the main features of the data and presents estimates of a conventional econometric model of total hours that distinguishes between union and non-union status. Data on approximately twenty-three thousand British male blue-collar (manual) employees, obtained from pooling fourteen consecutive cross-section surveys, are used to test the implications of the model. Only Earle and Pencavel (1990, hereafter EP), Sickles and Perloff (1987), Trejo (1993), Rubin (1993) and DiNardo (1991) have attempted to model the impact of union status on the relationship between hours and wages. Given the importance paid to hours in real-life negotiations between unions and employers, there has been unexpectedly little attention given to it in existing empirical work[4].

The behaviour of the union and non-union samples turns out to differ dramatically. Separate equations for the union and non-union samples reveal that the correlation between hours and wages for the union sample is negative or not significant, while the relationship for

3. Our method relies, therefore, on the plausible assumption that there is no money illusion.

4. Clark (1990), Andrews and Simmons (1991), Johnson (1990) and Bulkley (1992) contain theoretical models of *effort*. Sampson (1992), Booth and Schanterelli (1987), and Booth and Ravallion (1993) explicitly model hours but are directed at analysing the impact of government legislation over hours of work. They do not pursue the issues we raise in section 2. Houpis (1993), Rubin (1993) and DiNardo (1991) are among the few analyses to combine theory and empirical evidence in this field. Although done independently, some of our results overlap with theirs.

the non-union sample is strongly positive. Moreover, for standard hours of work, the wage/standard hours relationship is negatively sloped while it is positively sloped for the non-union sector. In both sectors, overtime hours are positively related to the wage. These results are consistent with the view that the union sample has its standard hours determined as a bargain on a contract wage-hours curve that is negatively sloped, but when all union members are employed overtime hours will be determined by the conventional model. In contrast, the non-union sample has both standard and overtime hours generated in a way consistent with the conventional model.

2 The Theoretical Framework

The aim of this section is to show that the predictions of a contract model are different from those of conventional labor supply theory. Unionized workers, for example, will typically not be on their individual labor supply curves. This simple point does not seem to have been made clear in the existing published literature.

Assume that the trade union is utilitarian[5] and cares about the sum of its employed and unemployed members' utilities. Let hours of work be h, the wage per hour be w, the level of employment be n, union membership be m, the utility of an employed person be u, while an unemployed person receives exogenous benefit of b which yields utility of $\mu(b) < u$[6]. Let θ be the firm's output price, which is distributed according to the density $g(\theta)$. Uncertainty is introduced here to allow the model to have demand shocks that lead to overtime. In the analysis, w will be a function of θ, for example. In this framework, utility is $u(y,h)$ and this

5 The term utilitarian union comes from Oswald (1982) but an equivalent per-capita form is used by McDonald and Solow (1981).

6 The assumption of exogenous b holds in almost every British union contract and in the majority of US ones (see Oswald and Turnbull (1985) and Oswald (1986)). As is well known, however, in theory unions should organize private unemployment insurance.

is indirectly a function of θ. Output is given by the production function $f(nh)$ which assumes that the firm is indifferent between hours and employees. A generalization is considered below. The firm's utility is a concave function defined over profits and is given by v.

Assume that the union and the firm bargain over pay, hours and employment (although the key results go through if there is no bargaining over the latter). Assume that in the event of a breakdown in negotiations the firm gets utility $\hat{v}$ and each union member gets utility $\hat{u}$. A bargain is assumed to fix a state-contingent wage, $w(\theta)$, a contingent level of hours, $h(\theta)$, and a contingent level of employment, $n(\theta)$. Using a generalized Nash framework, where η and $1-\eta$ are the bargaining strengths of the two sides, the problem can be written as that of choosing $w(\theta), n(\theta)$ and $h(\theta)$ to maximize

(1) $$\eta \log\left(\int [un + \mu(m-n) - \hat{u}m] g(\theta) d\theta\right) + (1-\eta)\log\left(\int [v - \hat{v}] g(\theta) d\theta\right)$$

However, the later derivations use only the efficiency conditions from a contract curve, so it is simpler to formulate the problem as that of choosing $w(\theta), n(\theta)$ and $h(\theta)$ to maximize

(2) $$\int \{u(y,h)n + \mu(b)(m-n)\} g(\theta) d\theta$$

subject to

(3) $$\int v(\theta f(nh) - whn) g(\theta) d\theta \geq \bar{v}, \text{ and } n \leq m$$

where $\bar{v}$ is an arbitrary constant, and $y = wh + i$ where i is unearned income. The first-order conditions for $w(\theta), h(\theta)$, and $n(\theta)$ are

(4) $$u_y - \lambda v'(.) = 0$$

(5) $$u_h + u_y w + \lambda v'(.)[\theta f'(.) - w] = 0$$

(6) $$u - \mu + \lambda v'(.)[\theta f'(.) - w]h = 0$$

where λ is the Lagrange multiplier associated with the constraint in (3)[7]. Seven results emerge.

Proposition 1 *Unions ration hours so that individuals are to the left of their privately rational labor supply curves.*

Proof Combine equations (5) and (6) to give

(7) $$u_h + u_y w + \frac{\mu(b) - u(y,h)}{h} = 0.$$

Because $\mu(b) \leq u(y,h)$ for a feasible equilibrium, this means that $u_h + u_y w \geq 0$. Assuming that the conventional individual choice problem is concave, this inequality implies that hours are less than at the individual optimum.

Proposition 2 *The hourly wage is (weakly) greater than the value of the marginal product of an hour of labor.*

Proof This condition, which is well-known in general from efficient contract models that abstract from hours, follows from equation (6). The requirement that $u - \mu \geq 0$ and $\lambda > 0$ implies that the term in square brackets in equation (6) is negative.

Proposition 3 *For any demand shock θ, a sufficient condition for wages and hours to be inversely related is that the individual's utility is separable in income and hours, and concave in each.*

Proof Rewrite equation (7) as the implicit function

(8) $$\psi(h,w) \equiv h[u_h + u_y w] + \mu - u(y,h) = 0.$$

The proposition asserts that

7 See Arthur (1975), pp50-51, for why λ is independent of θ in iso-perimetric problems of this kind.

(9) $$\frac{dh}{dw} = -\frac{\psi_w}{\psi_h} < 0.$$

Differentiating equation (8) gives

(10) $$\psi_h = hu_{yy}w^2 + hu_{hh} + u_h + u_y w - u_y w - u_h = h[u_{yy}w^2 + u_{hh}] < 0,$$

(11) $$\psi_w = h[u_y + u_{yy}wh] - u_y h = u_{yy}wh^2 < 0.$$

Hence, by equation (9), $dh/dw < 0$. An alternative condition relies on the properties of the firm's profit function.

Proposition 3′ *If the firm is risk-neutral, and leisure is a normal good, wages and hours are inversely related.*

Proof By equation (4), in this case, the marginal utility of income is a constant. Differentiating implicitly gives

(12) $$u_{yy}\{h.dw + w.dh\} + u_{yh}.dh = 0$$

so that $$\frac{dh}{dw} = -\frac{hu_{yy}}{wu_{yy} + u_{yh}} < 0$$

where normality of leisure guarantees that the denominator is negative.

Proposition 4 *If workers are risk-neutral with respect to income, and utility is separable, hours are independent of the wage.*

Proof By equation (9), dh/dw is zero if $\psi_w = 0$. By (11), this is guarantied if the second derivative of utility with respect to income is zero.

Proposition 5 *If the union is locally indifferent to employment, the optimal contract allows workers to be on their privately rational labor supply curves.*

Proof This case is formally equivalent to setting $u = \mu$ or $m = n$. Then (2) reduces to maximizing the expected utility of the typical employed union member. First-order conditions (5) and (6) become

(5′) $$u_h + u_y w + \lambda v'(.)[\theta f'(.) - w] = 0$$

(6′) $$\theta f'(.) - w = 0$$

which establishes the result. The weak-equality version of Proposition 2 then holds.

Proposition 6 *If the firm is risk-neutral, and utility is additively separable in income and hours, shocks to θ affect only employment. The wage and hours are constant.*

Proof Under these assumptions, equation (4) implies that income, y, is fixed. Equation (7) can then be written as

(7′) $$u(\bar{y},h)h + u_y(\bar{y},h)\bar{y} + \mu(b) - u(\bar{y},h) = 0$$

where $\bar{y}$ is the constant income level, and this establishes that, because θ does not enter explicitly, the level of h must be constant. Equation (6) can be written as

(6″) $$\text{constant} + \theta f'(.) - w = 0$$

so that a quasi-linear labor demand curve exists. Equation (6″) demonstrates that a rise in θ lead to an offsetting fall in the marginal product of labor. The latter is achieved, as in a labor demand equation, by an increase in the number of employees.

This model describes a non-linear contingent contract. Workers and the firm implicitly agree, for every possible level of demand, to levels of wages, hours and employment. In principle, the non-linearity of the pay and labor supply schedules can be thought of as allowing an unrestricted form of remuneration and overtime function.

Implicit in the model is the simple point that there are two dimensions along which a labor union can ration the flow of labour services to the firm. Proposition 1 captures the idea that a trade union will find it optimal to restrict not just the supply of workers but also the number of hours per worker. Because a first-order change in hours affects the firm's utility, at a contractual optimum the individual's marginal rate of substitution (between income and hours) does not equal the wage rate. If they care about their member's employment, unions here set a lower number of hours than the individual member would like to work.

Figure 1 illustrates the wedge between the individual worker's wage and his or her marginal rate of substitution. The upper half of the figure depicts the equilibrium of the textbook model at point e. As shown in the lower diagram, at e the net marginal utility of hours has gone to zero. This is not the equilibrium desired by a trade union, however, because it neglects the weight that the union puts upon total employment of members. The union would prefer point e'. This is where the individual worker's net marginal utility of hours equals the union's extra marginal disutility from hours. That disutility is $(u - \mu)/h$, where u is the utility of an employed union member, μ is the disutility of an unemployed union member, and h is the number of hours worked by an employed individual. Unlike a worker, the union cares about the total number of jobs and it is this feature that drives the key result. Hence, a rise in the number of hours worked per person has a cost to the union. Holding total labor costs fixed (and thus the firm's profits constant), more hours implies less people employed. The marginal return to the union from more employment is $u - \mu$, because that is the extra utility an unemployed person enjoys upon being employed. The per-hour gain is therefore $(u - \mu)/h$. The trade union thus wishes to enforce a point such as e' in Figure 1. This gives the optimal balance between catering to workers' preferences and holding down hours to keep employment high.

Proposition 5 states the exception to the rule. A trade union that represents only fully-employed members obtains no benefit from a first-order increase in employment; it therefore allows the firm to set the level of employment to equate the wage per hour to the marginal product of labor. A first-order change in employment then leaves profits unchanged. Because hours and employment are multiplicative, the same is true of a first-order change in hours per worker. Hence the firm is locally indifferent to hours, and the optimal contract allows individuals to choose whatever level of hours they wish. In this case, even under a union, the canonical labor supply model emerges.

As Proposition 3 shows, the model does not generate an upward-sloping individual labor supply curve, but rather a downward-sloping efficiency locus. The result rests upon the assumption that utility is additively separable in income and hours. This is sufficient for $dw/dh < 0$. Alternatively, if selling price θ is not held constant, Proposition 3′ shows that wages and hours will fluctuate in the opposite direction if leisure is normal and the firm is risk-neutral. This is another sufficient condition for $dw/dh < 0$. It is not, of course, necessary, and the point of the propositions is to indicate that, by continuity, a range of assumptions about utility functions can lead to an inverse relation between pay and hours of work.

Proposition 6 is of some interest because it gives conditions under which demand shocks alter the level of unemployment but not pay or hours. An issue commonly discussed in macroeconomic theory is that of why employment, in a capitalist economy, bears almost all of the adjustment to booms and slumps. Greenwald and Stiglitz (1993), for example, call this a major unsolved puzzle: they point out that economists would expect a demand fall to generate wage and hours reductions rather than layoffs. Proposition 6 makes slightly extreme assumptions, but gives the correct prediction. There is one other setting to which Proposition

6 may apply. Many white-collar jobs in real labor markets seem to specify in advance an annual salary and annual hours, but to reserve the right of the employer to vary employment at will. The model provides an optimizing rationale for this form of contract.

These propositions make predictions about the correlations that are to be expected in real-world data. Where a union cares locally about employment, it should act to hold down individuals' hours and thereby generate a negatively sloped locus between hours and wages. Where all its members have jobs[8], and employment is no longer a goal, a union will set hours to mimic the individual worker's optimal choice. In a sufficiently strong boom, hours of work may be determined as if by neoclassical labor supply theory.

These results have so far ben proved for a articular production function. Although the assumption that output is $f(nh)$ is a natural benchmark case, it is useful to consider the implications of the unrestricted production function $f(n,h)$. The central theoretical result, that the existence of union bargaining drives a wedge between the wage and the individual worker's marginal rate of substitution, continues to hold. The first-order conditions for an optimal contract become

(13) $$u_y + \lambda v'(.) = 0$$

(14) $$(u_h + u_y)n + \lambda v'(.)[\theta f_h - wn] = 0$$

(15) $$u - \mu + \lambda v'(.)[\theta f_n - wh] = 0$$

where subscripts denote partial derivatives. Hence, the individual's net marginal utility from hours worked is

(16) $$u_h + u_y w = -\frac{\lambda v'(.)[\theta f_h - wn]}{n}$$

8 The kink in union preferences at $m = n$ is discussed in Carruth and Oswald (1987).

The right-hand side of this equation is typically non-zero, which establishes the existence of a wedge. As might be expected, the wedge in the unrestricted case may be positive or negative. If the marginal value product of hours exceeds the marginal costs of hours, workers are to the right of their individually rational labor supply curves.

Consider, as an illustration, the Cobb-Douglas case $f = n^{\gamma}h^{1-\gamma}$. It is easy to check that workers are to be left (right) of their individual supply functions if the following term is negative (positive)

(17) $$\theta(1-\gamma)\left(\frac{n}{h}\right)^{\gamma} - wn > 0 \quad (<0)$$

This can be signed by multiplying equation (15) by n/h and invoking the requirement that employed workers receive greater utility than those who are unemployed. Then a sufficient condition for workers to be to the left of their individually optimal labor supply curves is that $\gamma \geq \frac{1}{2}$.

Empirical studies have not yet established how substitutable hours are for workers. An early paper by Feldstein (1967) argued that there is strong increasing returns and that the marginal product of hours is large. Leslie and Wise (1980) pointed out that, when controls for industry fixed effects are incorporated, Feldstein's results change dramatically. The authors' findings are close to a Cobb-Douglas function with $\gamma \approx 0.5$ which, as they point out, implies that total work hours can be treated as a homogeneous input. Hamermesh (1993) concludes that the issue is not settled.

For the unrestricted production function it does not seem possible to provide simple analytic generalizations of Propositions 2-6. Proposition 3′ does continue to hold, because it relies only upon equation (13) and the constancy of λ.

Although there is some empirical support for efficient bargain models in sources such a MaCurdy and Pencavel (1986), it might be argued that they suffer from one unrealistic feature. They implicitly assume that the union and the firm negotiate about the level of employment, whereas real labor contracts seem to allow the employer unilateral discretion over hiring and firing levels. This can be incorporated into the earlier framework by assuming that the union is dominated by senior employees who are insulated from job losses. Then the union is locally indifferent to changes in employment. To model this, define a maximum profit function

(18) $\pi(\theta, h, w) = \max_n \theta f(n, h) - whn.$

The optimal contract then solves the problem: maximize $\int U(y,h) g(\theta) d\theta$ subject to $\int v(\pi(\theta, h, w)) g(\theta) d\theta \geq \bar{v}$, with the first-order conditions

(19) $u_y h + \lambda v'(.)\pi_w = 0$

(20) $u_y w + u_h + \lambda v'(.)\pi_h = 0$

Equation (20) again has the feature that there is a wedge between wages and the individual employee's marginal rate of substitution. A simple monopoly union model implies the same (the proof is given in an earlier theoretical version of the paper, Oswald and Walker 1988)).

The remainder of this paper focuses largely on the hypothesis in Proposition 1. As has been noted, if the production function departs sufficiently from $f(nh)$, workers may be to the right of their supply functions. The later empirical work can therefore be viewed as an application of equation (16) rather than equation (7). In either case, there should exist a wedge between the wage and the unionized employee's marginal rate of substitution between income and hours.

3 Stylized Facts and Econometric Results

Comparatively little is known about the distribution of hours of work by union status, or its breakdown between standard and overtime hours. Earle and Pencavel (1990) report hours worked but not their breakdown[9], and find that for white male employees *weekly* hours for union members appears to be lower than for non-union workers by 3%. Their cross section regressions suggest an average -1.1% union/non-union weekly hours differential, which differs markedly across skill and industry groups, while Lewis (1986) suggests that the average is -1.8%. Earle and Pencavel's time series regressions suggest that union status has a consistently negative effect on *annual full-time* hours, although the effect is not precisely estimated. Perloff and Sickles (1987) estimate a model of hours, wages and union status for a sample of US construction workers and find that the union/non-union hours differential is of the order of -4%. DiNardo (1991) also estimates hours equations for the US, using the 1976-83 PSID, and finds, controlling for differences in observable characteristics, that the union hours differential is -3.6%. A recent paper by Trejo (1993) argues that it is important to distinguish between overtime and standard hours, and provides evidence from the US 1985 CPS. While average union hours are 40.5 compared to 38.2 for the non-union sample, 22.3% of the union sample had standard working weeks of less than 40 hours compared with 20.8% of the non-union sample. Thus, overtime hours tend to be longer for union workers, but standard hours are shorter[10].

There appears to be no systematic study of the relationship between hours of work and union status for the United Kingdom. As a preliminary to the estimation of a structural model of standard hours and overtime hours, a number of stylized facts are presented. This

9 Pencavel (1991), in his study of union effects on hours, wages and employment, contains only one reference to the effect of unionism on overtime. He suggests that the mechanism is via the demand side - unions raise the fixed costs of employment and firms respond by increasing their utilization of employees.

10 Trejo defines overtime hours as total hours minus 40 (rather than total hours minus standard hours) which tends to underestimate the number of overtime hours worked by the union sample relative to the non-union sample.

paper uses data from the UK Family Expenditure Surveys of 1979-1992[11]. Since our interest is in bargaining, wages and hours, we restrict our attention to male blue collar employees[12] which yields 23,123 observations. By focussing on blue collar male employees we capture the most highly unionized group. We also avoid having to deal with non-linearities in budget constraints due to the tax and welfare systems since almost all adult male manual workers earn at least enough to pay tax and escape the welfare system, and very few earn enough to put them above the threshold where higher rates of tax become relevant. Thus, the vast majority of the sample face the standard tax rate (plus the social security contribution) and are sufficiently far from the "kinks" in the constraint that we do not have to be concerned with how to model hours in the face of non-linear taxation. The standard tax band captures 96.7% of the male manual workers in our data. This is an advantage of British data. It makes it possible to sidestep the difficult issues associated with tax-induced non-linearities in the budget constraint that affect workers in most other developed countries.

3.1 Union and Non-Union Hours

Our sample of 23,123 men is drawn from consecutive random samples of the relevant population according to normal weekly hours of work exceeding 20[13], and age being between 21 and 64. The unionism rate is 61%, the union wage is £7.02 per (standard) hour, and the non-union wage is £5.98 at January 1993 prices. The raw union wage differential is 17.4%. Mean hours for union members is 43.67 and 44.96 for non-union workers, an hours differential of -2.9%. This decomposes into 39.51 standard and 4.16 overtime hours for union workers, and 40.85 standard and 4.11 overtime hours for non-union workers. Thus the standard hours differential is -3.3 % while the overtime hours differential is +1.2%. 48.7% of union workers work an average of 8.54 hours overtime while 44.9% of non-union workers work an average of 9.15 hours overtime. Therefore, union members are more likely to work overtime but tend to work fewer overtime hours if they do[14].

Figures 2 and 3 show the standard and overtime hours distributions by union status. The standard week is less likely to be exactly 40 for union members; it is more likely to be 38 or 39.

The theory suggests that there can readily be a negative relationship between union hours and wages. While some non-union members may be subject to contracts determined by unions, it might be expected that any negative relationship between hours and wages would be less pronounced among the non-union sample. Figure 4 plots the average wage and hours differentials by industry, and indicates that industries with high wage differentials (typically highly unionized ones) tend to have large negative hours differentials.

Econometric modelling of hours of work normally adopts the neoclassical labor supply framework[15]. Table 1 illustrates the application of that framework to these data. A feature of the labor supply literature has been the use of methods to control for the potential endogeneity of wages. These methods have usually been motivated by the simultaneity

11 Prior to 1978, FES does not contain education information. Post 1986 occupation is only coded for heads of households. Thus our sample is all blue collar prime age males up to 1986 and blue collar prime age male household heads thereafter.

12 White collar (non-manual) workers frequently work *unpaid* overtime which is clearly difficult to account for in a static model. The self-employed data are deficient in that the income figures do not accurately reflect aggregate data for a number of reasons. We do not analyse women because we would need to control for non-participation and the tax and social security systems.

13 Workers with very low weekly hours are dropped because of their preponderance of high recorded *normal* earnings despite having observed characteristics normally associated with low wages. Members of the armed forces were also excluded. Restricting the sample in these ways resulted in a loss in sample size of 1.1%. The results reported below are essentially unchanged when using the whole sample.

14 Union status is not directly recorded in the FES data. However, since it is an expenditure survey it includes expenditure on TU subscriptions from three sources: standing orders from bank accounts, cash payments, and direct deductions from pay. The latter is the most important category and the right to deduct subscriptions from pay is a strong indicator that the workers plant has union coverage since this right is commonly negotiated by unions.

It is difficult to compare this data with other available sources since union status is recorded only infrequently in British data. The data here compares favourably with the 1983 General Household Survey (GHS) in its industrial and occupational breakdowns of union status. GHS is extremely useful since, in addition to union membership, it also records union coverage (ie whether there exists a union at the individuals place of work) and the size of plant where the individual works. Since it might be argued that we are picking up a plant size effect in FES data in Appendix A we report a number of results from manual men from the 1983 GHS sample which support the findings in FES and control for plant size.

15 The literature on the impact of unions on wages is divided on the appropriate treatment of the endogeneity of union membership. One view is that union status is endogenous but the extent of bias is probably not large and, in any case, methods to control for this endogeneity tend to produce rather unstable results. Thus, for the present paper, we appeal to this view.

induced by the tax system, which causes the net marginal wage to fall as the level of hours rise. But there may be other reasons to suspect endogeneity, such as measurement error or some feature of technology that causes firms to want to use non-linear wage schedules. Recent work (for example, Mroz (1987) and MaCurdy (1992)) has emphasised the usefulness of instrumental variable techniques to control for wage endogeneity because of the difficulties of applying Maximum Likelihood methods.

This presumes that the data contain valid instruments and it is usually difficult to argue that this is the case. Mroz (1987) explains the dangers of inappropriate identification assumptions. We try to overcome the identification problem by exploiting two unusual features of the British data. First, the data contain two "natural experiments". In 1947 and again in 1973 the government increased the high-school minimum leaving age by one year. Since this affects schooling and hence wages, but should not directly affect hours, it ought to be a good instrument for the wage[16]. Second, our data were collected over a period of fourteen years, and we can date the interviews down to month. British labor contracts are annual and fixed in nominal terms. Thus there is within-year variation in the real wage induced by variations in the price level and the seasonal pattern to wage settlements[17]. This variation in the real wage should affect labor supply. Given fixed nominal wage contracts, the nominal price level enters the real wage equation but not the labor supply equation. Thus, in Table 1, we instrument the logarithm of the wage with region, skill, industry, age, age squared, education years, union status, marital status, a dummy variable indicating that the

16. Blundell, Duncan and Meghir (1993) use an alternative which exploits the time series variation in the tax rules to identify a model of female labor supply estimated over pooled cross sections of data. The tax system is relevant for women because of their lower wage and earnings relative to men.

17. Oswald and Turnbull (1985) conclude that indexed wage contracts are not found in Britain. The Government introduced mandatory indexation in 1977 but this lapsed in 1978.

individual was affected by one of the school leaving age changes, month dummies, and the monthly value of the consumer price index[18]. Unearned income is the sum of any spouse's income and all forms of asset income recorded in the data[19].

The results in Table 1 are quite dramatic[20]. Column 1 mimics the common finding that labor supply is negatively related to the wage[21]. In line with the theory, column 2 includes a union status dummy, and it is large and significantly negative. The wage term is now positive, although not significantly so. Column 3 estimates the usual model over the sample of non-unionized employees only. The wage term is now large and significantly positive, and unearned income is significantly negative. The wage elasticity at the mean hours is 0.11. In contrast, the unionized sample in column 4 exhibits no significant wage or income effects, and a wage elasticity of 0.011. The insignificance of the unearned income term is important since it might be expected that a union wage/hours contract would be independent of individual unearned income.

Almost the whole of the labor supply literature has assumed that it is legitimate to aggregate the union and non-union sectors. These results reject, strongly, the restrictions that the coefficients of union and non-union hours equations are the same. The two sectors' labor supply curves have very different slopes. Given these differences, the failure of earlier studies to control for union status is an important deficiency, and casts doubt on the validity of previous estimates of this relationship. In the light of these results it is difficult to explain

18. See Appendix B for the wage equation.

19. Defining unearned income as the difference between household total expenditure and the male earnings yields almost identical results. This suggests that life-cycle considerations are likely to be unimportant - probably because there is relatively little real wage variation for manual workers over the lifetime. Moreover, attempts to instrument unearned income variable made no effective difference to the analysis.

20. OLS results are in an appendix and show a similar but, as is to be expected, less well-determined pattern.

21. We experimented with non-linear forms and found that, without controlling for union status, the data suggest a U-shaped hours/wage relationship with high hours at low wages and high hours at high wages. This is the opposite of the conventional backward-bending story. Forward bending was also found by Atkinson and Stern (1980) and Brown, Levin and Ulph (1976). However, the significance of the square of the log wage disappeared in models that controlled for union status, and we do not report results from any of these experiments.

why the existing literature has not addressed the distinction between union and non-union hours, except to note that the data-sets used to analyse labor supply have often not recorded union status[22].

Two difficulties with the above results, and with the overwhelming majority of the existing literature, are that they aggregate standard and overtime hours and that they use the average wage. The temptation to ignore the standard hours and overtime hours distinction is strong in labor supply modelling. The reason is that an overtime premium causes a non-convex kink in the budget constraint and, in a random preference model, this would imply that no individuals would choose to work exactly the standard working week. Since a large proportion of any sample do precisely this, modelling the overtime kink would require a two-error specification to be used. Thus, accounting for overtime in the canonical model is quite difficult using Maximum Likelihood methods. In this section, standard hours and overtime hours are modelled separately, and we use the appropriate marginal wage in each case[23].

As a preliminary to structural modelling we report estimates of a simple reduced form model in Table 2 below. The model, following EP, is a straightforward linear form but we assume the dependent variable is the *level* of hours rather than the log of hours, to allow comparisons to be made between overtime and standard hours.

Table 2 gives reduced-form hours equations. It is not possible to reject the hypothesis that the coefficients are identical across the union and non-union samples, ie the simple

22 Trejo (1993) only provides estimates where union status affects the intercept. Given the way he defines overtime his overtime Tobit is comparable with the total hours equation in column 2 of Table 1. He also finds a strong negative union effect and strong positive average wage effect.

23 For those that work overtime, we observe both actual hours and earnings, and standard hours and earnings. We can therefore construct an overtime wage. For many individuals who do not *normally* work overtime we observe different actual (last week) hours, normal hours, and the corresponding earnings. In these two cases we can compute an overtime wage if the observed actual hours exceeds standard hours. A regression of overtime wages against actual wages indicated a relatively well-determined overtime premium close to 50%, and no evidence of selection bias induced by using the sample where the overtime wage could be derived. See Appendix B.

intercept shift specification for both the standard hours equation ($F_{37,23123} = 0.89$) and the overtime hours Tobit[24] equation ($F_{37,23123} = 1.12$). However, it is possible to reject the hypothesis that we can aggregate hours (ie that all but the constant terms in the standard and overtime equations are identical) for both the union sample ($F_{36,14096} = 40.21$) and the non-union sample ($F_{36,23123} = 71.12$). It is clear from the results that standard hours fall slightly with unemployment but are constant over time, and are lower for the union sample than the non-union sample[25]. Overtime hours are the same for the two samples, grow at the same rate over time, but are more sensitive to unemployment than are standard hours.

Since we can pool the union and non-union samples, the estimated union/non-union standard hours differential is simply -1.002, or -2.3%. The overtime differential is obtained by exploiting a decomposition of the difference in hours. This split is the difference between the probability of working overtime times the conditional expectation of overtime hours and the conditional expectation times the probability of working overtime[26]. Evaluating this at the non-union means yields an overtime hours differential of 0.24. Thus the overall hours differential is -0.76, or -1.8%.

DiNardo (1991), using PSID data, finds results that are qualitatively consistent with these. His estimates of the slope of the labor supply function are negative in the union sector and positive in the non-union sector. These instrument the wage with a *reported* hourly wage. However, both estimates in DiNardo (1991) are poorly determined . In contrast, DiNardo's estimated reduced-form effect of unions upon hours is very well-determined and negative.

24 The presumption is that overtime is a choice for the worker. An alternative is to assume a double hurdle framework (Cragg (1982)), but this requires that we have a means to code both hurdles for all observations. We have no realistic means of doing this since desired hours are not in our data. However, estimates of a truncated overtime regression yield estimates that are not significantly different from the Tobit estimates presented here.

25 This result is not comparable with Trejo's findings since he defines overtime as total hours minus 40. Thus, his results are consistent with the finding in column 1 of a negative union effect on total hours.

26 See McDonald and Moffitt (1980) for details.

3.2 A Structural Model of Standard and Overtime Hours

The bargaining theory in section 2 suggests that the hours/wage locus may, under plausible conditions, be negatively sloped. Proposition 5 implies that, when all relevant members are employed, workers will be on their labor supply curves. While this is impossible to observe directly in our data, the existence of overtime being worked may indicate that all of the union's members are employed, so that variations in employment is achieved by variations in hours of work along the supply of hours curve. Although speculative, this idea seems worth exploring empirically. Thus we attempt to distinguish between overtime and standard hours of work, and investigate the extent to which the former reflects supply considerations.

Overtime hours are modelled as a function of the wage, the level of income at standard hours, and the level of standard hours. Longer standard hours might be expected to decrease the probability of working overtime and to reduce overtime hours for those that work them (but by less than the increase in standard hours if both leisure and consumption are normal goods). Thus, the model can be formulated as

$$(21)\qquad h_i^o = \alpha^o \log w_i^o + \beta h_i^s + \gamma^o \mu_i^o + Z_i^o \delta^o + u_i^o, \qquad \text{if } h_i^{o*} > 0, \quad \text{else } h_i^o = 0$$

$$h_i^s = \alpha^s \log w_i^s + \gamma^s \mu_i^s + Z_i^s \delta^s + u_i^s$$

where $\log w_i^s = X_i^s \psi^s + v_i^s$, $\log w_i^o = \log w_i^s + X_i^o \psi^o + v_i^o$, $\mu_i^o \equiv \mu^s + w_i^s h_i^s$, and h_i^{o*} is the latent variable for desired overtime. The Z and X vectors are vectors of exogenous variables, μ indicates unearned income, and the superscripts indicate overtime and standard hours respectively. The coefficients are allowed to differ according to union status[27] and for $Cov[u^o, u^j] = \sigma_{oj} \neq 0$, $j = s, w$. If $\sigma_{oj} > 0$ the unobservables which are positively correlated with $j = w, s$ are positively correlated with long overtime.

27 Note that we are regarding union status as exogenous, an assumption that is commonly used in models of union wage differentials.

The likelihood function for this type of model is outlined in Blundell and Smith (1986) in the context of a Tobit hours model with endogenous unearned income, and is readily applicable to more than one endogenous variable. Here potential endogeneity arises for the overtime hours equation since it contains the wage, standard hours and standard income (unearned income plus the product of the wage and standard hours). The same procedure as in Blundell and Smith is adopted here: reduced form log wage and standard hours equations are estimated by least squares and the residuals from these are included in the Tobit overtime hours equation. Blundell and Smith show that this procedure provides consistent estimates of the Tobit equation. The results for the Tobit overtime equation and the standard hours equation, where the log wage has been instrumented as before, are presented in Table 3.

Blundell and Smith prove that their technique, in addition to providing consistent estimates under endogeneity, provides a test for exogeneity. This is in the form of a t test that the coefficient on the residuals from the auxiliary regression of the potentially endogenous variable in the Tobit equation is zero. Here, with two potentially endogenous variables we use a Wald test that the $\hat{u}_i^w$ and $\hat{u}_i^s$ coefficients are all zero. This hypothesis is strongly rejected in all samples[28].

The results for the union sector are not out of line with the theory in section 2: standard hours are a decreasing function of the wage while overtime hours are increasing in the wage. In contrast, in the non-union sample both standard and overtime hours are increasing in the wage. Moreover, as suggested by the canonical model, unearned income is negative in both

28 The estimates above adopt the restrictions implied by using a Tobit for the overtime equation. This implicitly restricts the determination of overtime working to be the same as overtime hours conditional on working overtime. The restrictions implied by the Tobit framework has been typically been rejected wherever they have been tested in the literature (for example Mroz (1987)). Here we test the Tobit by estimating the overtime equation as a censored regression and estimate participation in overtime as a probit equation with the same explanatory variables. A likelihood test which compares the Tobit with the sum of the probit and truncated regression fails to reject the Tobit specification for both union and non-union samples.

equations for the non-union sample, while it is only significantly negative in the overtime equation for the union sample. The estimates reject the restrictions that the two samples have the same parameters in both equations.

Conditional on overtime being worked, the elasticity of overtime hours with respect to wages is 1.24 for the non-union sample, and 0.83 for the union sample. An increase in the length of the standard week, holding standard income μ_i^s constant, reduces overtime hours but by quite a small fraction of the increase in standard hours, and the income effects are negative. The standard hours elasticity is smaller: 0.10 for the non-union sector and -0.01 for the union sector.

In order to compare these results with others in the literature, it is necessary to acknowledge the simultaneity between overtime hours and standard hours, the existence of the overtime premium, and the effect that a change in gross wage would have on the probability of working overtime, as well as the effect on overtime hours conditional on working overtime. The simplest way of computing a total hours elasticity is by simulation. The simulated effect of a 1% increase in the standard wage together with the associated increase in the overtime wage indicates an increase total expected hours by 0.61% in the non-union sector compared with a 0.23% rise in the union sector.

These elasticities are larger than those in the existing literature and, therefore, go some way towards bridging the gap between microeconometric estimates of the wage elasticity of labor supply and the macroeconometric estimates of the intertemporal elasticity of substitution noted by Nickell (1987). It might be thought that the results given in Table 1 of this paper imply that, relative to women, the labor supply elasticity of non-union men is fairly small. Table 1's estimate, in the third column, is approximately 0.12. However, estimates for women are around 0.25 in Mroz (1987) and similar values are common in British studies

(for example, Blundell and Walker (1986)). In Table 3, moreover, overtime hours are found to be highly responsive to wage variations. The existing literature has paid surprisingly little attention to overtime and no comparable figures seem to exist in the literature.

4 Conclusion

Because an understanding of labor supply decisions is important in both microeconomics and macroeconomics, there is a large econometric literature on the determinants of working hours. The principal conclusion from the literature on male labor supply is that hours of work are unresponsive to the wage rate. The results in this paper, however, suggest that in the non-union sector this conventional view is incorrect[29].

Using data on approximately twenty-three thousand male blue-collar workers, the paper finds that the union and non-union sectors exhibit quite different labor supply behaviour. In the non-union sector, the data appear to be consistent with a well-determined textbook labor supply curve. The wage elasticity of total hours is approximately 0.6 and the wage elasticity of overtime hours is 1.2[30]. In contrast, in the union sector, there appears to be a vertical or negatively sloped relationship between wages and hours, although there is a relatively well-determined positive overtime hours elasticity so that the overall elasticity of hours is about 0.2. The results imply that the orthodox empirical literature has mistakenly obtained an approximately vertical labor supply curve. It has done so by inappropriate aggregation across overtime and standard hours, and across union and non-union members[31].

29 A recent overview by Heckman (1993) suggests that male labor supply may be more elastic than most of the empirical modelling suggests because the elasticity of participation is high. He cites US studies. There is no modelling of male participation in Britain to support this view although there is a well developed literature that models the elasticity of unemployment duration with respect to the ratio of income in work to income out of work (see, for example, Lancaster and Chesher (1983)).

30 This latter is evaluated at the average overtime hours which is much smaller than total hours. This means that a 1% increase in the overtime wage increases the number of overtime hours by 1.2%.

31 This conclusion is reminiscent of Pencavel's (1986, p 95) conclusion that the canonical model "may be an apt description of some of the population, but a different characterization of behaviour may be more appropriate for others".

To account for the observed features of the unionized data, the paper has developed an efficient bargain model of wage and hours determination. The model can generate a negatively sloped contract curve in wage-hours space. For large unionized companies, where hours are fixed by negotiation, this framework seems a more natural one than the canonical labor supply model in which a worker may choose any number of hours.

It has been argued in the paper that the British economy offers an especially suitable test-bed for the estimation of labor supply curves. In this sample, more than 95% of the men face the same flat tax rate, so the simplicity of the British tax system is helpful to the econometrician concerned about the endogeneity of marginal income tax rates. Moreover, two natural experiments characterize the data. First, the minimum high-school leaving age was raised exogenously in 1947 and again in 1973. This altered wages independently of labor supply for old and young cohorts in the data. Second, British wage contracts are annual and unindexed, and the period covered by the data saw substantial price inflation. Hence, with monthly data, the changes in the nominal price index generate monthly movements in real wage rates that help to identify the hours-of-work equation. For these reasons, British data are unusually helpful in their provision of instrumental variables[32].

32 The paper's estimates might be thought to be especially relevant to countries with low rates of trade unionism. This begs the question of why results such as these have not emerged from earlier US studies. A natural explanation lies in the nature of the data-sets used in most American studies. These are predominantly from the 1960's and 1970's, and typically study married white males older than 25. The union membership rate in such samples (see Kokkelenberg and Sockell (1985)) approaches that found in this British data; but union status is typically not recorded in the US sources, so this paper's methods were not available to most earlier US researchers. As discussed earlier, DiNardo (1991) contains US results that are qualitatively consistent with the findings presented here.

References

Arthur, A.M. Calculus of Variations, Routledge and Kegan Paul, London, 1975.

Abowd, J.M. and Card, D. "Intertemporal Labor Supply and Long Term Employment Contracts", American Economic Review **77** (1987): 50-68.

Andrews, M. and Simmons, R. "Effort Bargaining", mimeo, Salford University, 1991.

Atkinson, A.B. and Stern, N.H. "On the Switch from Direct to Indirect Taxation", Journal of Public Economics **14** (1980): 195-224.

Blundell, R.W. "Taxation and Labour Supply: A Survey", Fiscal Studies, **13** (1992): 15-40.

Blundell, R.W., Ham, J. and Meghir, C.H.D. "Unemployment and Female Labour Supply", Economic Journal **97** (1987): 44-64.

Blundell, R.W., Duncan, A. and Meghir, C.H.D. "Robust Estimation of Labour Supply Responses in the Presence of Taxes", mimeo, Institute for Fiscal Studies, London, 1993.

Blundell, R.W. and Smith, R. "An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labour Supply", Econometrica **54** (1986): 679-685.

Blundell, R.W. and Walker, I. "A Life-cycle Consistent Empirical Model of Family Labour Supply", Review of Economics Studies **54** (1986): 163-182.

Booth, A. and Schanterelli, F. "The Employment Effects of a Shorter Working Week", Economica 54 (1987): 237-248.

Booth, A. and Ravallion, M. "Employment and Length of the Working Week in a Unionised Economy in which Hours of Work Influence Productivity", Economic Record, forthcoming.

Brown, C.V., Levin, E. and Ulph, D.T. "Estimates of Labour Hours Supplied by Married Male Workers in Great Britain", Scottish Journal of Political Economy **23** (1976): 261-277.

Bulkley, G. "Does a Trade Union Set a Lower Effort Level than would be Determined in a Competitive Labour Market?", Bulletin of Economic Research **44** (1992): 153-160.

Carruth, A.A. and Oswald, A.J. "On Union Preferences and Labour Market Models: Insiders and Outsiders", Economic Journal **97** (1987): 431-445.

Clark, A. "Efficient Bargains and the McDonald-Solow Conjecture", Journal of Public Economics 8 (1990): 502-528.

Dickens, W. and Lundberg, S. "Hours Restrictions and Labor Supply", International Economic Review 34 (1993): 169-192.

DiNardo, J. "Union Employment Effects: An Empirical Analysis", Discussion Paper 90-92-06, University of California, Irvine, December 1991.

Earle, J.S. and Pencavel, J. "Hours of Work and Trade Unionism", Journal of Labor Economics 8 (1990): S151-S174.

Feldstein, M. "Specification of the Labour Input in the Aggregate Production Function", Review of Economic Studies 34 (1967): 375-386.

Greenwald, B. and Stiglitz, J.E. "New and Old Keynesians", Journal of Economic Perspectives 7 (1993): 23-44.

Hamermesh, D. Labor Demand, Princeton University Press, Princeton, 1993.

Hausman, J. "Taxes and Labor Supply". In A. Auerbach and M. Feldstein (eds), Handbook of Public Economics, North-Holland, Amsterdam, 1985.

Heckman, J.J. "What Has Been Learned about Labor Supply in the Past Twenty Years?", American Economic Review (Papers and Proceedings) 83 (1993): 116-121.

Hoel, M. "Short and Long Run Effects of Reducing Working Time in a Unionised Economy", Working Paper 10, University of Oslo, 1984.

Houpis, G. "The Effect of Lower Hours of Work on Wages and Employment", mimeo, London School of Economics, London, 1993.

Johnson, G. "Work Rules, Feather-Bedding and Pareto-Optimal Union-Management Bargaining", Journal of Labor Economics 8 (1990): S237-259.

Kokkelenber, E.C. and Sockell, D.R. "Union Membership in the United States, 1973-1981", Industrial and Labor Relations Review 38 (1985): 497-543.

Lancaster, T. and Chesher, A.D. "An Econometric Analysis of Reservation Wages", Econometrica 51 (1983): 1661-1676.

Leslie, D.G. and Wise, J. "The Productivity of Hours in UK Manufacturing and Production Industries", Economic Journal 90 (1980): 74-84.

Lewis, H.G. Union Relative Wage Effects: A Survey, University of Chicago Press, Chicago, 1986.

McDonald, I.M. and Solow, R.M. "Wage Bargaining and Employment", American Economic Review 71 (1981): 896-908.

McDonald, J. and Moffitt, R. "The Uses of Tobit Analysis", Review of Economics and Statistics 62 (1980): 318-321.

MaCurdy, T. "Work Disincentive Effects of Taxes: A Reexamination of the Evidence", American Economic Review (Papers and Proceedings) 82 (1992): 243-249.

Moffitt, R. "The Tobit Model, Hours of Work and Institutional Constraints", Review of Economics and Statistics 64 (1982): 510-515.

Mroz, T.A. "The Sensitivity of an Empirical Model of married Women's Hours of Work to Economic and Statistical Assumptions", Econometrica 55 (1987): 765-800.

Nickell, S.J. "The Short Run Behaviour of Labour Supply". In T. Bewley (ed) Advances in Econometrics - Fifth World Congress, Cambridge University Press, Cambridge, 1987.

Oswald, A.J. "The Microeconomic Theory of the Trade Union", Economic Journal 92 (1982): 576-595.

Oswald, A.J. "Unemployment Insurance and Labor Contracts under Asymmetric Information: Theory and Facts", American Economic Review 76 (1986): 365-377.

Oswald, A.J. and Turnbull, P.J. "Pay and Employment Determination in Britain: What are Labour Contracts Really Like?", Oxford Review of Economic Policy 1 (1985): 80-97.

Oswald, A.J. and Walker, I. "Union Bias in Estimates of Labour Supply Functions", Working Paper 1106, Centre for Labour Economics, London School of Economics, 1988.

Pencavel, J. "Labor Supply". In O. Ashenfelter and P.R.G. Layard (eds) Handbook of Labor Economics, North-Holland, Amsterdam, 1986.

Pencavel, J. Labor Markets under Trade Unionism: Employment Wages and Hours, Basil Blackwell, Oxford, 1991.

Perloff, J.M. and Sickles, R.C. "Union Wage, Hours and Earnings Differentials in the Construction Industry", Journal of Labor Economics 5 (1987): 174-210.

Rosen, S. "Implicit Contracts: A Survey", Journal of Economic Literature 23 (1985): 1144-1175.

Rubin, M. "What do Unions do to Hours? Evidence from WIRS 1990", mimeo, London School of Economics, London, 1993.

Sampson, A. "The Anti-Social Charter: A Theoretical Analysis of Choice of Wages and Hours Worked in a Right to Manage Model", mimeo, Salford University, 1992.

Trejo, S.J. "Overtime Pay, Overtime Hours and Labor Unions", Journal of Labor Economics **11** (1993): 253-278.

van Soest, A., Woittiez, I. and Kapteyn, A. "Labor Supply, Income Taxes and Hours Restrictions in the Netherlands", Journal of Human Resources 25 (1991): 527-558.

Appendix A: General Household Survey Results

This appendix shows that the results in the text can also be found in another British data set - the General Household Survey (GHS). This data set records union status in a conventional way and allows us to control for plant size. However, it does not allow us to distinguish between standard and overtime hours.

The GHS data are a sample of 2318 male manual employees aged 21 to 64 inclusive from the 1983 survey[33]. Union membership is recorded, and whether or not there is a union at the workplace (union coverage). The raw data supports the FES data and are detailed in Table A1. The total hours differential is -2.4% compared to -2.5% in FES.

Table A1 GHS Data

Sample	All	Covered	Not covered	Member	Not member
Standard hours	39.71	39.42	40.78	39.40	40.37
Overtime	3.92	3.99	3.70	4.06	3.64
Total	43.63	43.40	44.48	43.46	44.00
Wage (£ 1983)	3.12	3.24	2.68	3.30	2.71
N	2318	1826	492	1592	726

Here we report the results where we use union coverage as our method for splitting the sample. Similar results apply for union membership. The major drawback of the GHS is that the wage measure is average hourly earnings since there is no possibility of computing the overtime wage. Thus we do not report GHS estimates of the simultaneous model in Table 4. The wage effects are not significant in the GHS results but the effect of union presence at the workplace is essentially the same as the union effect in FES. Table A2 suggests that the FES results would be robust to including plant size.

33 We are grateful to Andrew Lillico for his help in preparing these data.

Table A2 Total Hours equations for the General Household Survey Data

	All (OLS)	All (IV)	Covered (IV)	Not Covered (IV)
Cover=1	-0.964 (0.468)	-1.22 (0.59)		
Log wage	-	6.45 (5.37)	4.10 (0.55)	10.16 (8.13)
Unearned income	-	0.0001 (0.0002)	0.0001 (0.0003)	0.0000 (0.0003)
Size 1-2	2.75 (1.21)	4.22 (1.79)	7.14 (2.58)	7.01 (3.68)
Size 3-24	1.89 (0.52)	3.05 (1.13)	2.42 (1.26)	7.06 (2.95)
Size 25-99	1.89 (0.48)	2.76 (0.89)	1.95 (1.08)	6.72 (2.53)
Size 100-999	1.32 (0.41)	1.86 (0.63)	1.43 (0.72)	5.63 (2.20)
Constant	42.38 (1.00)	36.09 (5.26)	38.70 (7.44)	29.55 (9.18)
$\overline{R}^2$	0.03	-		
	2318	2318	1592	726

Note: Models include month, region, industry and skill controls; Cols 2-4 use the school leaving age increases and the retail price index as instruments for the wage.

Appendix B: Auxiliary Family Expenditure Survey Results

Table B1 Log Real Wage Equation (t stats)

Variable	Average	Standard	Overtime
Constant	0.921 (39.12)	0.893 (23.13)	0.492 (5.21)
Education years	0.054 (27.22)	0.045 (19.28)	0.007 (0.001)
$\log w_i^*$	-	-	0.932 (13.87)
Age	0.038 (23.28)	0.035 (19.44)	0.011 (2.11)
Age^2	-0.0004 (11.82)	-0.0004 (7.32)	0.0000 (0.91)
Skilled	0.179 (31.11)	0.166 (21.31)	0.027 (3.11)
Semi-skilled	0.065 (10.64)	0.059 (6.73)	0.011 (2.33)
Unemployment	-0.014 (3.06)	-0.009 (1.56)	-0.002 (1.01)
ROSLA Dummies	-0.033 (9.92)	-0.031 (7.89)	-0.012 (1.82)
Consumer Price Index	-0.015 (5.63)	-0.017 (3.88)	0.006 (0.92)
Union member	0.163 (12.22)	0.152 (9.92)	0.028 (2.11)
$\hat{\lambda}_i^o$	-	-	0.059 (1.90)
$\overline{R}^2$	0.332	0.366	0.111
N	23,123	23,123	11,210

Note - Month, Year, Industry and Region dummies are also included. $\hat{\lambda}_i^o$ is the Mills ratio from a reduced form overtime Probit which includes all the wage equation variable and unearned income. ROSLA is "Raising of the School Leaving Age". The rate of return to an additional year of *compulsory* education is approximately 2.1% (0.054-0.033) in column 1.

Table B2 OLS Estimates of Family Expenditure Survey Total Hours Equations

Dependent variable	Total Hours			
Sample	All	All	Union	Non-union
Constant	44.73 (1.52)	42.78 (1.21)	36.21 (2.88)	41.11 (4.01)
Union Dummy	-	-1.012 (0.101)	-	-
Wage (£)	-0.721 (1.39)	0.810 (0.462)	2.878 (2.71)	0.558 (0.49)
Unearned income (£)	-0.006 (0.003)	-0.009 (0.003)	-0.009 (0.006)	-0.003 (0.003)
$\bar{R}^2$	0.037	0.044	0.048	0.033
N	23,123	23,123	9,027	14,096

Note - the equations include year/region/industry and marital status dummies, age, age squared, education, and a time trend. Standard errors in parentheses.

Table 1 Estimates of Total Hours Equations

Dependent variable	Total Hours			
Sample	All	All	Non-union	Union
Constant	42.182 (1.226)	40.421 (1.191)	33.511 (1.890)	40.722 (2.791)
Union Dummy	-	-1.173 (0.102)	-	-
Log Wage (£)	-1.103 (0.391)	0.783 (0.449)	4.762 (1.106)	0.481 (0.402)
Unearned income (£)	-0.009 (0.002)	-0.009 (0.002)	-0.018 (0.005)	-0.001 (0.002)
$\bar{R}^2$	0.042	0.051	0.053	0.039
N	23,123	23,123	9,027	14,096

Note - the equations include month, year, region, industry and marital status dummies, age, age squared, and education years. Standard errors in parentheses.

Table 2 Estimates of Hours Equations by Union Status

Dependent variable	Total Hours (OLS)			Standard Hours (OLS)			Overtime Hours (TOBIT)		
Sample	All	Non union	Union	All	Non union	Union	All	Non union	Union
Constant	50.513 (1.05)	48.425 (1.61)	50.216 (0.99)	42.502 (0.77)	40.921 (1.29)	42.315 (0.77)	7.411 (1.54)	7.310 (3.10)	8.410 (2.10)
Time trend	0.209 (0.05)	0.255 (3.01)	0.181 (0.049)	-0.016 (0.051)	0.000 (0.055)	-0.023 (0.029)	0.553 (0.064)	0.598 (0.122)	0.67 (0.079)
Regional Unemployment	-0.301 (0.029)	-0.283 (0.049)	-0.293 (0.041)	-0.083 (0.021)	-0.102 (0.044)	-0.088 (0.020)	-0.442 (0.045)	-0.472 (0.088)	-0.421 (0.058)
Union dummy	-0.931 (0.118)	-	-	-1.002 (0.077)	-	-	0.551 (0.200)	-	-
$\bar{R}^2$	0.060	0.054	0.066	0.047	0.043	0.035			
Log$L$							-18729	-11427	-11982
	23,123	9,027	14,096	23,123	9,027	14,096	23,123	9,027	14,096

Note: The equations also include 10 regional, 20 industry, 3 occupational dummy variables, a marital status dummy, age, age squared, and education. Standard errors in parentheses.

Table 3 Estimates of a Simultaneous Model of Overtime and Standard Hours

Sample	All		Non-union		Union	
Dep var	Standard Hours	Overtime hours	Standard Hours	Overtime hours	Standard Hours	Overtime hours
Constant	38.168 (1.281)	-8.132 (2.020)	32.939 (2.390)	-10.290 (3.200)	40.201 (1.392)	-10.872 (2.939)
Union dummy	-1.317 (0.097)	-0.012 (0.221)	-	-	-	-
$\log w_i^s$ (£)	0.182 (0.721)	-	4.012 (1.183)	-	-0.232 (0.661)	-
μ_i^s	0.009 (0.004)	-	-0.037 (0.005)	-	0.013 (0.002)	-
$\log w_i^o$	-	9.128 (0.792)	-	11.532 (1.502)	-	7.129 (1.542)
h_i^s	-	-0.143 (0.035)	-	-0.082 (0.032)	-	-0.133 (0.044)
$\mu_i^s + w_i^o h_i^s$	-	-0.025 (0.003)	-	-0.030 (0.004)	-	-0.009 (0.004)
Log$L$		-18,412	-	-7,221		-11,201
$\bar{R}^2$	0.101		0.112		0.091	
N	23,123		9,027		14,096	

Note: the models also include the variables in table 1. Standard errors in parentheses.

Figure 1 *Hours Determination in a Union Contract*

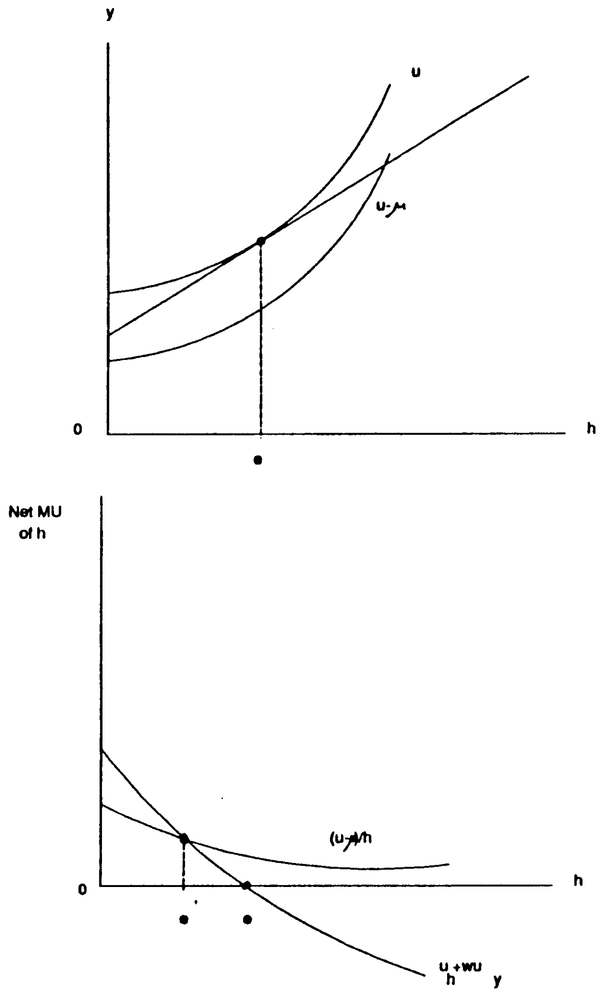


Figure 2 Standard Hours of Work

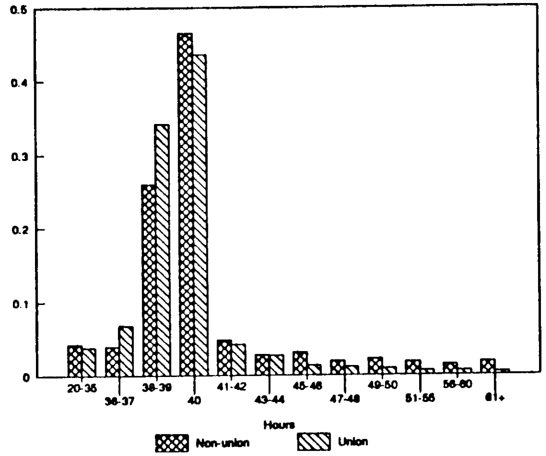


Figure 3 Overtime Hours and Union Status

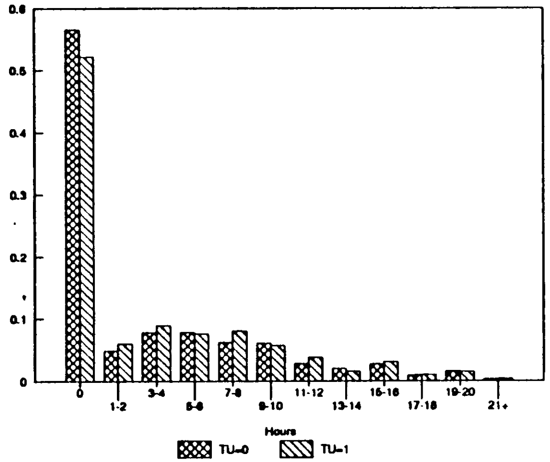
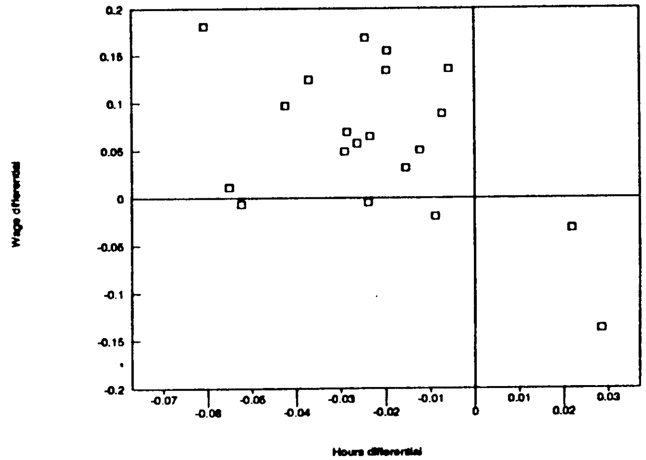


Figure 4 Wage and Hours Diffs by Industry



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