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Mark B. Stewart and Joanna K. Swaffield
Department of Economics
University of Warwick
Coventry CV4 7AL
UK

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Mark B. Stewart
University of Warwick

Joanna K. Swaffield
University of Warwick

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Abstract

This paper investigates constraints on desired hours of work using information on hours preferences from the British Household Panel Survey for 1991. Over a third of male manual workers would prefer to work fewer hours at the prevailing wage than they do and we estimate that on average desired hours per week are 4.3 lower than actual hours. We hypothesize that job insecurity and scarcity of alternative job opportunities enable employers to set hours constraints above employee preferences and find that the minimum hours constraints set by firms are an increasing function of the unemployment rate an individual faces.

Key words: hours constraints, labour supply, desired hours, job insecurity, switching models.

JEL classification: J22, C24

The canonical model of labour supply is used extensively for policy analysis. A central tenet of this model is that individuals have free choice over hours, selecting their desired utility-maximising outcome at any given wage. In this paper we present evidence that a large proportion of men in the British labour market would prefer to work either fewer or more hours at the prevailing hourly wage (with appropriate total earnings adjustment), predominantly *fewer*. There is not free choice of hours within a job and only limited choice across jobs. Job offers typically have hours constraints bundled with the wage. In this paper we model these constraints for a sample of manual men and suggest that the prevalence of such constraints calls into question policy analysis based on pure labour supply models.

British men work longer hours than their counterparts in all other European Community countries.[1] Why are hours of work so long in Britain? In this paper we present evidence that over a third of men in Britain work longer hours than they would wish at the prevailing wage and estimate that the mean of desired hours for manual men is 4.3 hours per week less than that of actual hours worked. Why are men working longer hours than they wish? This question is particularly pertinent in the light of the persistently high levels of unemployment and the currently re-emerging debate about "work sharing".[2]

A number of authors have provided evidence that hours of work, controlling for wages, are significantly affected by unemployment rates and several alternative theoretical explanations of this have been proposed. In this paper we argue that individual job insecurity, fear of redundancy and scarcity of alternative job opportunities enable firms to force those in employment to work more hours than they would wish at the

[1]The average number of hours usually worked per week by full-time male employees in the UK in 1991 was 45.2 as compared with an average across the other 11 EC countries of 40.2 (Labour Force Surveys). More than a third of male full-time employees work 46 hours a week or more in the UK as compared with 1 in 20 across the rest of the EC. The UK is also unique among EC countries in that male hours have risen over the last decade or so. The above male average was 43.9 hours per week in 1983, whereas the EC average stayed roughly constant over the same period. See Stewart and Swaffield (1995) for more details.

[2]See Gregg (1994). Earlier contributions to the debate include Hart (1984), Calmfors (1985) and Booth and Schiantarelli (1987).

prevailing wage and we present evidence in support of this hypothesis.

Age is one of the most widely documented correlates with male hours (see for example Bell and Hart, 1994). Total hours per week exhibit an inverted-U shape age profile and this results from a similar profile in overtime hours (with no difference in basic hours). This is usually interpreted as a supply-side influence. However in this paper we present evidence that there is no such profile in desired hours and that this shape of age-profile in observed hours results from employers placing different hours constraints on workers of different ages.

Recently there has been increased interest in bargaining models of hours setting for unionised workers (Oswald and Walker, 1993, Andrews and Simmons, 1994). These papers introduce hours into a standard bargaining model and contrast the hours outcome from this process with that in the canonical labour supply model assumed to hold for non-union workers. Union workers are off their labour supply curves, while non-union workers are assumed on theirs. Under the utilitarian union assumptions of the Oswald-Walker model, for example, union workers are rationed to work fewer hours than comparable non-union workers.[3] In this paper we argue that non-union workers too are prevented from attaining their utility-maximising labour supply response due to hour-wage bundling, and that the evidence does not suggest that union workers are any more (or less) constrained than comparable non-union workers.[4]

1 Models of individual hours determination

The canonical model of labour supply is well known and has been extensively used in empirical work, although less empirical work has been conducted for men than for

[3]This prediction can be reversed under different objective function assumptions.

[4]In the raw data those covered by a trade union at their workplace, despite working on average 1.7 hours less per week than those with no union at work (45.2 against 46.9), are more likely than non-union workers to want to work *shorter* hours per week than they do (40.8% against 36.3%) and slightly less likely to want to work more hours per week (7.9% against 9.0%). See Stewart and Swaffield (1995) for more detail.

women.[5] The empirical model for observed hours, h, is taken to be that implied by the first order condition from utility maximization subject to a budget constraint. A central feature of this model is the assumption that the individual's choice set covers all possible hours of work. This does not necessarily mean that the individual has a free choice of hours with his current employer, but rather that the feasible set of jobs for the individual between them present a free choice of hours. Is this assumption likely to be valid? When demand is high the individual may be required to work overtime and when it is low the individual may be put on short time. In both cases h is selected by the employer. In these circumstances the above model assumes that the individual simply moves to another firm offering the desired hours. In practice this response may be hindered by mobility costs on individuals and by firms collectively requiring minimum hours, due to facing fixed costs or technology-related coordination requirements.[6]

The opposite polar case to the canonical model is the "take it or leave it" hours model.[7] In this case the individual chooses h equal to either $\overline{h}$ or 0 to maximize utility subject to the budget constraint, where $\overline{h}$ is the employer's "take it or leave it" hours offer, and there is no scope for moving employer. In this model the individual simply compares $\overline{U}$ (the level of utility if $h = \overline{h}$ is chosen) with U^0 (the level of utility if $h = 0$ is chosen). The individual only works if $\overline{U} > U^0$ and it may be that $\overline{h} > h^*$, the desired level of hours, or that $\overline{h} < h^*$. In both cases the first order condition for an interior solution described above will not hold. Mobility weakens this outcome, with individuals moving to employers who offer hours closer to their preferences and employers who offer unpopular hours having difficulty recruiting or retaining workers. Thus mobility will move workers toward their labour supply schedule. However if fluctuations in product demand mean that employers are continually adjusting $\overline{h}$ and

[5]See Pencavel, 1986, for a survey of male labour supply.

[6]Card (1990) argues that constraints result from a nonconvexity in the relationship between output and individual hours due to start-up costs or other aspects of the technology employed.

[7]See for example Pencavel, 1986, p. 41.

if there are mobility costs or alternative employment opportunities are limited, this movement may be insufficient for many workers to reach their labour supply schedules.

Various extensions that allow for less restrictive demand-side constraints on individual choice than in this model have been investigated. Moffitt (1982) proposes a model in which firms impose minimum hours constraints. If desired hours exceed this minimum, then observed hours are the solution to the first order condition in the canonical model. Those with desired hours, h^*, below the constraint level, h^L, choose between working no hours and working h^L. Moffitt assumes that the individual will choose zero hours if h^* is more than D hours below h^L and h^L otherwise. This cutoff point D will be a function of the shape of the individual's indifference curves. Moffitt specifies stochastic equations for h^* and h^L, but takes D to be the same for all individuals.[8] Which individuals are constrained is not observed in Moffitt's data. Kahn and Lang (1991) investigate constraints on hours of work using data on reported desired hours and find considerable divergence from actual hours.[9]

How are individuals forced to work more hours than they would prefer? We can think about this in terms of the efficiency locus in wage-hours space between a utility-maximizing worker and a profit-maximizing firm.[10] Under standard conditions, this locus will extend south-east (i.e. toward lower wages and higher hours) from the competitive equilibrium point and lie to the right of the individual's labour supply schedule (Naylor, 1996).[11] This part of the efficiency locus is generated by factors that

[8]In the estimated model (based on US negative-income-tax experiment data for prime-age married men with children) D is estimated to be 37 hours, while the mean of h^L is estimated to be 39 hours. Thus only those with extremely low desired hours will select $h = 0$ as opposed to $h = h^L$.

[9]Other papers on hours restrictions include Ham (1982), Lundberg (1985), Altonji and Paxson (1988) and Dickens and Lundberg (1993). Ilmakunnas and Pudney (1990) also use hours preference data to consider choices among non-participation, part-time working and full-time working. Blundell et al (1987) incorporate demand constraints but allow only that some of those with zero observed hours have positive desired hours. Those with positive hours of work are assumed to be working their desired number of hours.

[10]Worker responses in this paper are viewed in an individual context. It may also be useful to view them in a household context. The difference between the desired and actual hours of one partner may be influenced by constraints faced by the other. This may be a fruitful avenue for future research.

[11]Such a model is similar to the union bargaining model of Oswald and Walker (1993), but without a union. In the Naylor model the focus is on the firm's power to push the worker south-east to a

give the firm additional power in its attempts to retain workers, such as thinness of the distribution of outside alternative job opportunities or mobility costs. These create a gap in expected lifetime utility between the current job and the next best alternative. Such factors will determine how far the efficiency locus extends. Job insecurity due to fear of redundancy will then influence how far down this locus, towards the utility level of the next best alternative, the firm can force the employee;[12] and hence how far the employee's hours of work will exceed his labour supply schedule.[13]

2 Data on hours preferences

In this paper we utilise information contained in the British Household Panel Survey (BHPS) on the difference between desired and actual hours of work to investigate constraints on hours choice.[14] Those in work are asked: "Thinking about the hours you work, assuming that you would earn the same amount per hour as at present would you prefer to: Work *fewer* hours than you do now (1); Work *more* hours than you do now (2); Or carry on working the *same number* of hours? (3)."[15]

Of male employees aged 21-64, 36% would prefer to work fewer hours at the prevailing hourly wage.[16] Among manual workers 38.8% would prefer to work fewer

lower level of utility than at the competitive equilibrium point. In the Oswald-Walker model the union extracts a higher level of utility to the north-west.

[12]See Rebitzer and Taylor (1995) for a model in which firms use redundancy threats to regulate work effort, resulting in hours constraints and workers off their labour supply schedules.

[13]It might be argued that workers will adjust their input in these circumstances by reducing effort per hour or by absenteeism. However an individual who is working longer hours than desired due to job insecurity is likely also to be discouraged from these actions by the same fear.

[14]The BHPS results throughout this paper use the third release of Wave 1 of the BHPS.

[15]The explicit statement that the respondent is to hold the hourly rate of pay constant and that they are answering in relation to their main job makes clear the leisure-work trade-off that is being proposed. Bell and Freeman (1994) used responses to questions with similarly explicit statements concerning the hourly rate of pay to compare the preferences of German and US workers.

[16]This figure is consistent with evidence from a recent NOP survey which found 35% of male full-time employees to be working more hours than they wanted to (N.O.P., 1995). Further evidence of UK male employees working more hours than desired is contained in an EC survey in which 37% of respondents stated a preference for reduced working time when asked "Assuming that your present hourly rate remained unchanged would you like to work less, as long or longer?" (EC, 1991). In contrast, evidence from the BSAS conflicts with the BHPS and these surveys, giving a higher proportion wanting more hours than wanting fewer. However the questions on the BSAS do not explicitly refer to keeping the hourly rate the same. There would therefore seem to be greater scope for misinterpretation by respondents.

hours (Table 1) and 8.4% would prefer to work more hours. Thus 47.2% indicated that their desired and actual hours differed.[17] The proportion wanting to work fewer hours rises with hours actually worked, although not monotonically (Table 1). This increase is particularly marked for those working 46 hours or more, and almost half of those working over 50 hours per week would prefer to work fewer hours.

The proportion desiring fewer hours is greater among those working overtime than among those who are not, which does not sit well with the idea of freely chosen overtime hours. This proportion also rises with the number of overtime hours worked (Table 1). These findings suggest that some overtime at least is involuntary. This is supported by evidence from a recent NOP survey that 36% of male full-time employees have no choice over whether or not to work overtime (N.O.P., 1995). Not all overtime is paid. Among those working only unpaid overtime the percentage wanting to work fewer hours is similar to that among those not working any overtime (Table 1). Among those who work no overtime there is also evidence of a strong relationship between standard, or basic, hours and the proportion wanting to work fewer hours: 20% of those with standard hours of 35 or below do, as compared with 32.7% of those with standard hours of 40 and 41.3% of those with standard hours of 46 or more.

In this paper we argue that it is job insecurity, fear of redundancy and scarcity of alternative job opportunities that encourages an employee to accede to a firm's requirement for hours above those preferred. Hence a firm is able to place a higher minimum hours constraint on an employee if the individual faces a higher level of unemployment outside the job, by linking the working of extra hours to the probability of continued employment. This hypothesis is supported by the NOP survey referred to above, in which 60% of male full-time employees identified fear of losing their job as an important reason for working longer hours than they used to and 47% felt that their employer "takes advantage of the fact that people are afraid of losing their jobs"

[17]These figures are higher for manuals than non-manuals. We focus on manual men throughout this paper, there being considerable difficulties with the definition of hours for non-manuals.

in this context (N.O.P., 1995).

3 A model for constrained hours choices

Assume that desired hours of work, h^*, are determined by the equation

$$h_i^* = x_{1i}'\beta_1 + \varepsilon_{1i} \tag{1}$$

where x_{1i} is a vector of characteristics that influence desired hours, β_1 a vector of coefficients and ε_{1i} a random error term. Firms however place limits on the hours that a particular individual can work. Assume that, for the i-th individual, the set of firms in which the individual could be employed offer hours which between them cover the range

$$h_i^L \leq h_i \leq h_i^U \tag{2}$$

The relationship between actual (observed) hours, h, and desired hours is given by

$$h_i = \begin{cases} h_i^U & \text{if} \quad h_i^* > h_i^U \\ h_i^* & \text{if} \quad h_i^L \leq h_i^* \leq h_i^U \\ h_i^L & \text{if} \quad h_i^L > h_i^* \end{cases} \tag{3}$$

The individual's response to the BHPS question described at the start of section 2 is taken to indicate which of these three conditions hold. We ignore the possibility that the individual with $h_i^* < h_i^L$ may choose not to work.

The model is then completed by a specification of the process that determines the constraints for a particular individual. We assume initially that

$$h_i^L = x_{2i}'\beta_2 + \varepsilon_{2i} \tag{4}$$

$$h_i^U = h_i^L + \gamma \tag{5}$$

The width of the range between the lower and upper limits that firms set is initially constant. The positioning of this range varies across individuals as a result of both observed characteristics (of employer and employee), x_{2i}, and a random error term, ε_{2i}. We also consider a model in which γ varies with x_{2i}.

Under independence of the error terms ε_1 and ε_2, which we consider first, the desired hours and firm-imposed constraints equations can be estimated separately. Observed hours are given in terms of the determinants of desired hours by

$$h_i = \begin{cases} h_i^U & \text{if } x_{1i}'\beta_1 + \varepsilon_{1i} > h_i^U \\ x_{1i}'\beta_1 + \varepsilon_{1i} & \text{if } h_i^L \leq x_{1i}'\beta_1 + \varepsilon_{1i} \leq h_i^U \\ h_i^L & \text{if } x_{1i}'\beta_1 + \varepsilon_{1i} < h_i^L \end{cases} \tag{6}$$

If in addition we take $\varepsilon_{1i} \sim N(0, \sigma_1^2)$, this is a two-limit Tobit model (see Maddala, 1983, pp.160-2). The likelihood function is given by

$$L = \prod_{I_i=2} \left\{ 1 - \Phi\left(\frac{h_i^U - x_{1i}'\beta_1}{\sigma_1} \right) \right\} \prod_{I_i=1} \frac{1}{\sigma_1} \phi\left(\frac{h_i - x_{1i}'\beta_1}{\sigma_1} \right) \prod_{I_i=0} \Phi\left(\frac{h_i^L - x_{1i}'\beta_1}{\sigma_1} \right) \tag{7}$$

where $I_i = 2$ if individual i would prefer to work more hours, $I_i = 1$ if individual i would prefer to work the same number of hours and $I_i = 0$ if individual i would prefer to work fewer hours. Maximization of this provides estimates of β_1 and σ_1.

Similarly, under independence, we can estimate the parameters of equations (4) and (5) by treating observed hours as generated by

$$h_i = \begin{cases} x_{2i}'\beta_2 + \gamma + \varepsilon_{2i} & \text{if } x_{2i}'\beta_2 + \varepsilon_{2i} < h_i^* - \gamma \\ \text{indeterminate} & \text{if } h_i^* - \gamma \leq x_{2i}'\beta_2 + \varepsilon_{2i} \leq h_i^* \\ x_{2i}'\beta_2 + \varepsilon_{2i} & \text{if } x_{2i}'\beta_2 + \varepsilon_{2i} > h_i^* \end{cases} \tag{8}$$

This is a variant of the friction model considered by Rosett (1959) (see also Maddala, 1983, pp. 162-5). Assuming $\varepsilon_{2i} \sim N(0, \sigma_2^2)$, the likelihood function is given by

$$\begin{aligned} L \;=\; & \prod_{I_i=2} \frac{1}{\sigma_2} \phi\left(\frac{h_i - x_{2i}'\beta_2 - \gamma}{\sigma_2} \right) \prod_{I_i=1} \left\{ \Phi\left(\frac{h_i - x_{2i}'\beta_2}{\sigma_2} \right) - \Phi\left(\frac{h_i - x_{2i}'\beta_2 - \gamma}{\sigma_2} \right) \right\} \\ & \prod_{I_i=0} \frac{1}{\sigma_2} \phi\left(\frac{h_i - x_{2i}'\beta_2}{\sigma_2} \right) \end{aligned} \tag{9}$$

and provides ML estimates of β_2, σ_2 and γ.

The above assumes that the error terms in the desired hours and constraint equations, ε_1 and ε_2, are uncorrelated. This assumption may not hold if, for example, there are omitted variables common to the two equations. The model can be extended to the correlated errors case and details of this are given in Stewart and Swaffield (1995).[18]

[18] This model is a generalised form of the Roy model with endogenous switching between 3 ordered states. See Heckman and Honoré (1990) for a full treatment of the standard Roy model and Magnac (1991) for a labour market application.

In the current context, the estimated coefficients in this more general model are very similar to those presented below and the estimated correlation between the errors is insignificantly different from zero.

We follow Blundell at al (1995) in adopting the following functional form for the desired hours equation:

$$h^* = g'\alpha_0 + \alpha_1 \ln w + \alpha_2 \frac{y}{w} + \varepsilon_1 \tag{10}$$

This is a versatile functional form in terms of the shape of the labour supply responses that it permits and is consistent with various theoretical extensions of the standard model, while being parsimonious in form and linear in parameters.

Even with all individuals on their labour supply curves, OLS estimation of equation (10) for those in work may result in a sample selection bias. However the magnitude of this bias is likely to be far less important than for women. Pencavel (1986) in his extensive survey of male labor supply states that he "know[s] of no evidence ...that documents grievous biases from a strategy of restricting estimation to the sample of workers and of not making any correction for this deliberate nonrandom selection of the observations" (p. 55). In this paper we ignore this potential selection problem in order to focus on the issue of constraints on the hours of those who work.

The BHPS does not provide separate information on basic and overtime earnings, but does separate basic and overtime hours. We therefore construct the marginal net overtime wage as $w = (1+p)E(1-t)/(h_b + (1+p)h_{po})$, where E is gross weekly earnings, t the individual's marginal tax rate, h_b basic hours, h_{po} usual paid overtime hours and p the overtime premium. (p is set at 0.5 in the tabulated results, but their lack of sensitivity to this choice is discussed in the next section.) The sum of the two hours components in the denominator of this variable differs from the hours variable to be modelled, the difference being usual unpaid overtime hours, h_{uo}. Total hours worked are given by $h = h_b + h_{po} + h_{uo}$. Since hours variables are used in the construction of the wage rate, any errors in measuring "true" hours worked may

induce a spurious negative correlation between w and h.[19]

The measurement error problem is one reason why it is often argued to be necessary to instrument the wage when estimating labour supply functions. In addition an increase in h may raise an individual to a higher tax band, giving another reason to treat w as endogenous. In our sample this is in fact unlikely to be very important: only 2% of the sample have a marginal tax rate different to the basic rate, 9 out of 764 being below the lower tax threshold and 7 above that for higher rate tax.

To take account of (and test for) this potential endogeneity we adopt the method proposed by Smith and Blundell (1986) for a single-limit Tobit model, adding a reduced-form wage equation residual, $\hat{v}$, as an endogeneity correction term and taking the significance test on this added variable as a test of weak exogeneity.[20] The usefulness of these procedures of course depends crucially on the instrument set chosen. The appropriate wage in the constraint equation is the gross wage, which is constructed analogously to the net wage above, but without the deduction of tax. Its potential endogeneity is treated in the same way as that of the net wage in the desired hours equation.

The income variable, y, is constructed as total individual non-labour income net of tax adjusted to a weekly basis.[21] We also include a quadratic in age and dummy variables for marital status and the presence of a union at the workplace as controls in the desired hours equation.

Turning to the determinants of the firm-set lower hours constraint, it was argued in section 1 that the rate of unemployment that the individual would face, if separated from his current job, influences how high employers can set this hours requirement. It is the fear of redundancy and its consequences that encourages an employee to accede to a firm's requirement for hours above those preferred. The relevant unem-

[19]The difference in the two hours measures used (between hours paid and hours worked) will act to reduce this potential spurious correlation.

[20]Further details of the test in the current context are given in Stewart and Swaffield (1995).

[21]The tax rate applied is that at $h = 0$, rather than at observed h.

ployment rate is taken to be that for those in the individual's age and gender group in the region in which he resides. Thus the male age-specific regional unemployment rate (from the 1991 Census) is used. The marginal (gross) wage (in log form) and productivity-influencing characteristics are also included: an employer's prefered hours for an individual might be argued to be influenced by the surplus generated by that individual. Firm size dummies are included to proxy the firm's product market power. It should be stressed that identification of the desired hours and constraint equations does not require exclusion restrictions when the errors are taken to be independent. Identification is provided by the covariance restriction. The exclusions are for reasons of parsimony rather than identification.

There is little consensus with regard to the choice of suitable instruments for the wage in labour supply equations. In reviewing the male labour supply literature we found the most commonly used wage instrument to be education. However the appropriateness of this as an instrument is somewhat questionable, since others have found education to have an effect on hours (see Pencavel, 1986). Examination of the data used here suggests that this is less of a problem in the case of manual workers. However its validity as an instrument is still questionable in this case since years of education have little effect on the wages of manual workers (rather affecting the probability of an individual becoming non-manual). Another commonly used instrument is age (and its square) or experience (and its square). However the appropriateness of this given the strong age-profile in hours of work seems very questionable. Other studies have used race, health and location dummies and local unemployment rates.

We use years of education, sets of qualification, region and firm size dummies, and the male age-specific regional unemployment rate as the primary instruments of the net wage in equation (10). We then consider the effect of adding the square of years of education, the interaction between years of education and age, interactions between the educational qualification dummies and age and interactions between the

firm size dummies and the age-specific regional unemployment rate to the instrument set. The residuals from reduced form wage equations with these two instrument sets are denoted $\hat{v}_1$ and $\hat{v}_2$ respectively.

4 Results on desired hours and constraints

The estimation results for the uncorrelated errors case are presented in Table 2. Columns (2) and (5) present the results when the wage variables in both equations are treated as exogenous. OLS estimates of the desired hours equation are presented in column (1) for comparative purposes.

The OLS estimates exhibit the familiar age profile. Ceteris paribus, hours initially rise with age (at about half an hour per year), but at a declining rate of increase, reach a peak at around 35 and then decline. This is of course holding the wage, which itself exhibits an age profile, fixed. The two-limit Tobit estimates of the desired hours equation (column 2) show a complete reversal of the age-hours profile. The two variables are, however, individually and jointly insignificant at conventional levels. There is a strong age profile in the constraint equation (column 5) with minimum hours increasing with age up to 42 and then declining. h^L is estimated to be higher by about 16 hours per week at age 42 than at age 21. The inverted-U shaped age profile in actual (observed) hours is thus the result of the age profile in the minimum hours constraint rather than that in desired hours.

The estimated coefficients on $\ln w^n$ and y/w^n are negative and highly significant in both columns (1) and (2).[22] Given the functional form adopted (equation 10), the (uncompensated) wage elasticity is given by $(\alpha_1 - \alpha_2(y/w))/h$. The OLS estimates evaluated at the means of h and (y/w) give a value of -0.201. This is similar to typical estimates of male labour supply in the UK. Pencavel (1986) reports an average

[22] None of the results discussed are substantially altered if a different (constant) overtime premium is assumed or if an average premium for each 4-digit industry (from the NES) is assigned to each individual. See also footnote 24.

across the 8 UK studies he considers of -0.16. If we evaluate the wage elasticity for each individual in the sample, the upper and lower deciles are -0.146 and -0.260. The two-limit Tobit estimates of α_1 and α_2 are both about a quarter down on the corresponding OLS estimates. Elasticities in this case are evaluated at the means of (y/w) and predicted h^*. The implied uncompensated wage elasticity at the means is -0.175 and when evaluated separately for each individual the upper and lower deciles are -0.153 and -0.205. Note that the wage elasticity of desired hours at the means (and at the top of this range) is less than that of actual hours.[23]

The income elasticity is given by $\alpha_2 y/hw$. The OLS estimates, again evaluated at the means of h and (y/w), give a value of this elasticity of -0.016. These estimates imply an income-compensated wage elasticity of 0.361, positive as required. Evaluation for each individual in the sample gives only 4 Slutsky failures out of 764. The two-limit Tobit estimates give an income elasticity of -0.014 and an income-compensated wage elasticity of 0.259. In this case the estimated compensated elasticity is positive for all individuals in the sample, i.e. there are no Slutsky failures at all.

In the model being used, the conditional expectation of h_i^* given h_i is given by

$$E(h_i^*|h_i, I_i; x_{1i}) = \begin{cases} x_{1i}'\beta_1 + \sigma_1 \frac{\phi(z_i)}{1-\Phi(z_i)} & \text{if } I_i = 2 \\ h_i & \text{if } I_i = 1 \\ x_{1i}'\beta_1 - \sigma_1 \frac{\phi(z_i)}{\Phi(z_i)} & \text{if } I_i = 0 \end{cases} \tag{11}$$

where $z_i = (h_i - x_{1i}'\beta_1)/\sigma_1$ and ϕ is the density function of a standard normal. The mean of desired hours is estimated (replacing β_1, σ_1 by their ML estimates) to be 41.7 as compared with a mean of 46.0 for actual hours. Thus the estimates suggest that on average this sample of manual men would like to work 4.3 hours fewer per week than they do. Histograms of actual and estimated desired hours (given in Figure 1) show an increased frequency in hours groups below 40. Actual and estimated desired hours are plotted against one another in Figure 2. The observations on the diagonal correspond to $I_i = 1$ cases, those above and below the diagonal to $I_i = 2$ and $I_i = 0$

[23] If the minimum hours constraint was independent of the wage, we would expect the reverse of this. But, as will be discussed below, the wage has a strong negative effect on the constraint.

cases respectively. The shape of the curves for the off-diagonal groups is characteristic of models of this type. However it is noticeable that for those who wish to work fewer hours at the prevailing wage, few have desired hours above 40 and almost none above 45.

The diagnostic score test statistics in both cases do not suggest any problems of misspecification of the functional form or heteroskedasticity in the equation. However there is a strong rejection of the hypothesis of normally distributed errors. This is perhaps not too surprising given the large spike in observed hours at 40 and the elongated right-hand tail. However it is problematic for the consistency of the ML estimator. Further work is required on the robustness of the estimates to non-normality.

The age-specific regional unemployment rate has a significant positive effect on h^L (an asymptotic 't-ratio' of 2.9).[24] A higher unemployment rate faced by the individual enables firms to place higher minimum hours requirements on the individual. The hypothesis put forward earlier in the paper is supported by the data. Since lower product demand will lead firms to set lower h^L, there will be an offsetting effect resulting in this coefficient underestimating the hypothesized insecurity effect.[25]

The marginal (gross) wage has a strong negative coefficient and is highly significant. Other (productivity-influencing) factors equal, those with higher wages face less constraining minimum hours requirements.[26] The estimate of γ is large: the upper constraint on hours faced by a given individual from the set of *all* potential firms in which he could work is about 32 hours above the minimum hours requirement.[27]

[24] This result is not sensitive to the overtime premium used in the construction of the wage rate variable. The coefficient varies between 89.0 and 86.2 (with a t-ratio of 2.9 in all cases) as the overtime premium varies between zero and 100%. When industry-specific average premia from the NES are used, the coefficient varies between 87.9 and 88.7 (with again a t-ratio of 2.9 in all cases) for 1, 2, 3 and 4-digit averages. See also footnote 22.

[25] A supply-side effect of the unemployment rate might also be hypothesized, reflecting intertemporal substitution. However this is not supported by the data. The same unemployment rate variable when added to the h^* equation is insignificant with an asymptotic 't-ratio' of -0.5.

[26] In the agency model of Lazear (1981) hours constraints are a function of job tenure. However job tenure is insignificant when added to the h^L equation. The coefficients and t-ratios on the wage and unemployment variables all increase (in absolute value) when it is added.

[27] Testing this model against one in which γ is a function of x_2 gives a $\chi^2(10)$ likelihood-ratio statistic of 13.81. The variables are individually and jointly insignificant and we cannot reject the

We now turn to the potential endogeneity of the wage variables. We consider two alternative instrument sets as described in the previous section. Columns (3) and (4) give the results of adding the reduced form wage equation residuals to the two-limit Tobit estimates of the desired hours equation and columns (6) and (7) the results of adding them to the friction model estimates of the constraint equation.

The wage coefficient in the desired hours equation is very sensitive to the instrumenting of the wage.[28] Whichever instrument set is used the endogeneity correction term is significantly different from zero and the exogeneity of the marginal net wage is rejected. The estimated wage coefficients are rather different in the two cases (positive when $\hat{v}_1$ is added, negative when $\hat{v}_2$ is added), but in both cases insignificantly different from zero. The difference caused by adding the interaction terms as extra instruments suggests a great deal of caution should be applied to the estimated wage coefficients. The income coefficient is unchanged by the addition of a correction term.

The wage coefficient in the constraint equation in contrast is rather insensitive to the instrumenting of the wage, although its standard error increases greatly. The coefficients on the endogeneity correction terms have very low asymptotic 't-ratios' and in both cases the null of exogeneity of the gross wage in the constraint equation cannot be rejected. The coefficients on all the other variables in the constraint equation are also insensitive to instrumenting the wage.

As stated in the previous section, allowing the error terms in the desired hours and constraint equations to be correlated has little effect on the estimated coefficients. (The results are given in Stewart and Swaffield, 1995.) For both equations the estimated coefficients are very similar to those obtained under independence (Table 2) and the correlation between the errors is insignificantly different from zero.

constancy of γ.

[28] Mroz (1987) finds the same in an observed hours equation for American married women.

5 Conclusions

This paper investigates constraints on desired hours of work using information on preferences from the British Household Panel Survey. The main findings of the paper are as follows.

- Many of the men in our sample of manual workers would prefer to work fewer hours at the prevailing hourly wage. We estimate that on average for the whole sample desired hours are lower than actual hours by 4.3 hours per week. Thus cutting hours may increase utility for many workers. This paper has not addressed the issues of whether or not such a cut would increase employment and/or productivity. It does however suggest that in this debate it is inappropriate to assume that all workers are working their desired number of hours prior to any cut.

- The minimum hours constraints set by firms are an increasing function of the unemployment rate the individual faces. We hypothesize that this results from the individual's increased job insecurity and fear of redundancy and reduced alternative job opportunities at higher unemployment rates.

- The age profile in actual hours is not matched by that in desired hours. Rather it is found to be the result of the age profile in firm-imposed constraints.

- The minimum hours constraint is found to be a negative function of the wage: higher minimum hours requirements are placed on low paid workers, other things equal.

- The effects of union status on desired hours, the minimum hours required and the probability of working more hours than wished were not found to be significant.

References

Altonji, Joseph G. and Christina H. Paxson (1988) - "Labor supply preferences, hours constraints, and hours-wage trade-offs", Journal of Labor Economics, 6, 254-276.

Andrews, M.J. and R. Simmons (1994) - "Friday may never be the same again: towards a union-firm bargaining model over hours, the workweek, wages and employment", mimeo, July, University of Manchester.

Bell, David N.F. and Robert A. Hart (1994) - "Working time in Great Britain, 1975-1990", mimeo, May, University of Sterling.

Bell, Linda and Richard Freeman (1994) - "Why do Americans and Germans work different hours?", NBER Working Paper No. 4808.

Blundell, Richard, John Ham and Costas Meghir (1987) "Unemployment and female labour supply", Economic Journal, (Conference Papers Supplement, vol 97), 44-64.

Blundell, Richard, Alan Duncan and Costas Meghir (1995) "Estimating labour supply responses using tax reforms", mimeo, Institute for Fiscal Studies.

Booth, Alison and Fabio Schiantarelli (1987) - "The employment effects of a shorter working week", Economica, 54, 237-248.

Calmfors, Lars (1985) - "Work sharing, employment and wages", European Economic Review, 27, 293-309.

Card, David (1990) - "Labor supply with a minimum hours threshold", Carnegie-Rochester Conference Series on Public Policy, 33, 137-68.

Dickens, William T. and Shelly J. Lundberg (1993) - "Hours restrictions and labour supply", International Economic Review, 34, 169-192.

European Community (1991) - "Developments on the labour market in the Community", European Economy, 47, March.

Gregg, Paul (1994) - "Share and share alike", New Economy, 13-19.

Ham, John C. (1982) - "Estimation of a labour supply model with censoring due to unemployment and underemployment", Review of Economic Studies, 49, 335-354.

Hart, Robert A. (1984) - Shorter working time, a dilemma for collective bargaining. Paris: OECD.

Heckman, James J. and Bo Honoré (1990) - "The empirical content of the Roy model", Econometrica, 58, 1121-49.

Ilmakunnas, Seija and Stephen Pudney (1990) - "A model of female labour supply in the presence of hours restrictions", Journal of Public Economics, 41, 183-210.

Kahn, Shulamit and Kevin Lang (1991) - "The effect of hours constraints on labour supply estimates", Review of Economics and Statistics, 93, 605-11.

Lazear, Edward (1981) - "Agency, earnings profiles, productivity and hours restrictions", American Economic Review, 71, 606-620.

Lundberg, Shelly (1985) - "Tied wage-hours offers and the endogeneity of wages", Review of Economics and Statistics, 67, 405-10.

Maddala, G.S. (1983) - Limited-dependent and qualitative variables in econometrics, Cambridge: Cambridge University Press.

Magnac, Th. (1991) - "Segmented or competitive labor markets", Econometrica, 59, 165-87.

Moffitt, Robert (1982) - "The tobit model, hours of work and institutional constraints", Review of Economics and Statistics, 64, 510-15.

Mroz, Thomas A. (1987) - "The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions", Econometrica, 55, 765-99.

Naylor, Robin (1996) - "Labour supply, efficient bargains and countervailing power", mimeo, February, University of Warwick.

N. O. P. (1995) - Stress at Work, Tabulations prepared for Granada Television Ltd.

Oswald, Andrew and Ian Walker (1993) - "Labour supply, contract theory and unions", Working Paper, November, Institute for Fiscal Studies.

Pencavel, John (1986) - "Labour supply of men: a survey" in O. Ashenfelter and R. Layard (eds), Handbook of Labour Economics, Amsterdam: North-Holland.

Rebitzer, James B. and Lowell J. Taylor (1995) - "Do labor markets provide enough short-hour jobs? an analysis of work hours and work incentives", Economic Inquiry, 33, 257-273.

Rosett, R.N. (1959) - "A statistical model of friction in economics", Econometrica, 27, 263-7.

Smith, Richard J. and Richard W. Blundell (1986) - "An exogeneity test for the simultaneous equation Tobit model", Econometrica, 54, 679-85.

Stewart, Mark B. and Joanna K. Swaffield (1995) - "Constraints on desired hours of work, trade unions and the length of the working week for British men", mimeo, October, University of Warwick.

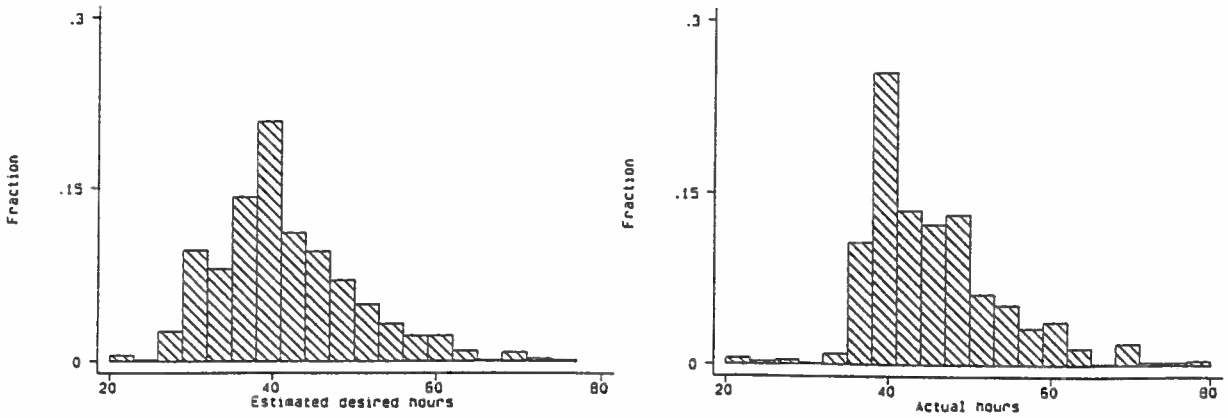

Figure 1

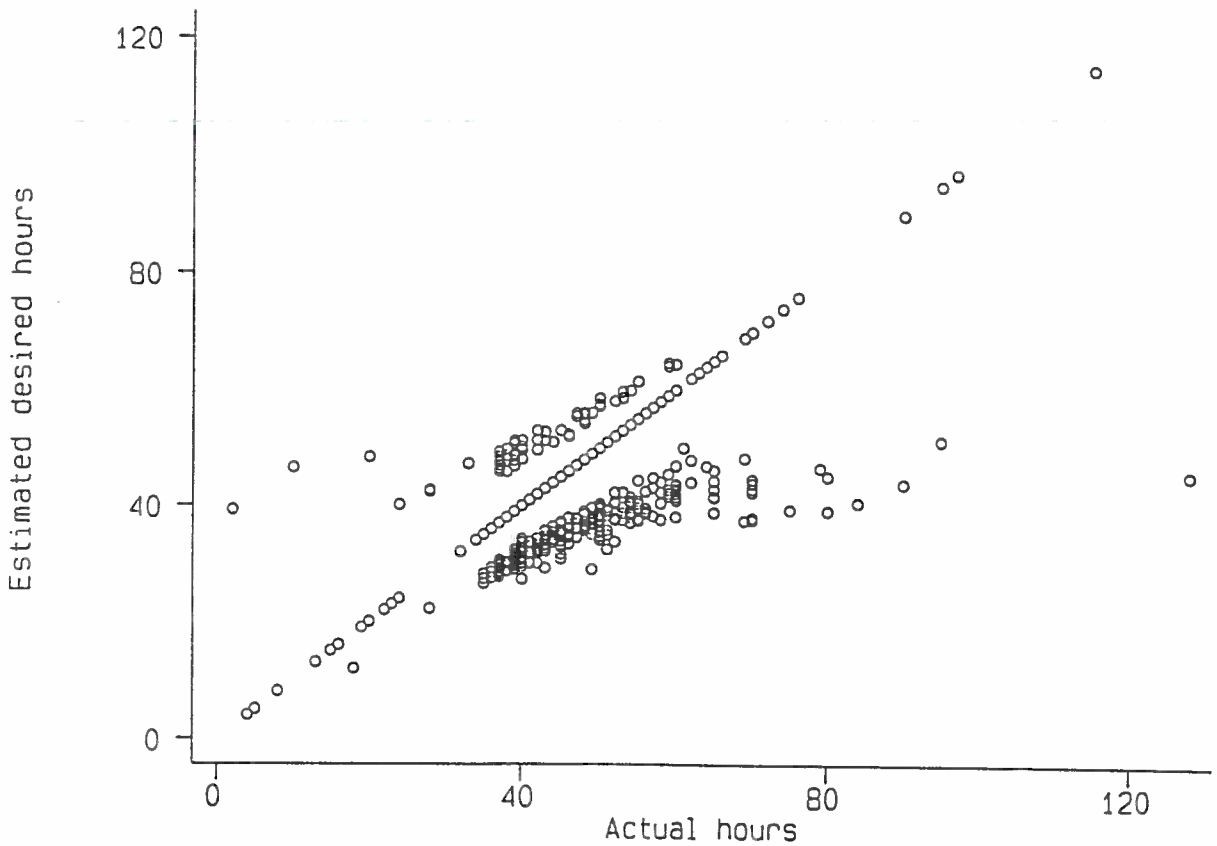

Figure 2

Table 1

Hours preferences by total hours and overtime working

Male manual employees aged 21-64

Total hours*	% wanting to work fewer hours	Overtime hours*	% wanting to work fewer hours
35	20.0	Not working overtime*	34.2
36 - 38	31.8	Working overtime*	42.3
39	38.2	Working paid overtime	42.8
40	30.8	Working only unpaid overtime	35.1
41 - 45	33.7		
46 - 50	44.5	Hours of overtime*	
51	49.8	1 - 5	32.8
		6 - 10	43.9
All	38.8	11 +	49.7

Source: British Household Panel Survey. Sample = 1020.

* Unless otherwise stated, overtime hours include both paid and unpaid hours.

Table 2

Estimated Hours of Work Models

	Means of Variables	(1) OLS h	(2) 2-limit Tobit h*	(3) 2-limit Tobit h*	(4) 2-limit Tobit h*	(5) Constraint eq. h^L	(6) Constraint eq. h^L	(7) Constraint eq. h^L
Age/10	3.895	4.773 (2.531)	-4.051 (3.015)	-7.573 (3.331)	-6.621 (3.264)	30.351 (6.179)	30.326 (6.703)	29.958 (6.526)
$(\text{Age}/10)^2$	16.515	-.712 (.306)	.245 (.364)	.690 (.406)	.570 (.397)	-3.628 (.719)	-3.625 (.786)	-3.581 (.763)
Married	.802	4.109 (1.005)	3.147 (1.176)	2.527 (1.195)	2.716 (1.190)	4.170 (1.611)	4.166 (1.663)	4.106 (1.647)
Union	.616	-.531 (.810)	-.645 (.970)	-2.071 (1.126)	-1.672 (1.091)	-1.549 (1.373)	-1.555 (1.515)	-1.647 (1.470)
$\ln(w^n)$	1.699	-10.015 (1.137)	-7.888 (1.138)	.763 (3.789)	-1.644 (3.380)			
y / w^n	1.313	-.562 (.121)	-.434 (.138)	-.464 (.137)	-.460 (.138)			
$\ln(w^g)$	1.986					-9.840 (1.787)	-9.776 (6.898)	-8.825 (5.730)
Education	11.390					-.466 (.235)	-.467 (.261)	-.483 (.253)
Unemployment rate	.109					87.793 (29.891)	87.787 (29.897)	87.686 (29.891)
Firm Size 2	.263					3.204 (1.685)	3.197 (1.862)	3.086 (1.801)
Firm Size 3	.365					2.962 (1.646)	2.952 (1.972)	2.799 (1.865)
Firm Size 4	.102					1.841 (2.385)	1.824 (2.938)	1.583 (2.757)
Constant		53.996	65.336	58.436	60.387	-11.226	-11.277	-12.057
Endogeneity correction terms:								
v_1				-10.012 (4.085)			-.068 (7.134)	
v_2					-7.494 (3.705)			-1.123 (6.030)
σ_1		10.468	10.898	10.820	10.845			
σ_2						15.211	15.211	15.209
γ						31.791 (1.695)	31.791 (1.697)	31.780 (1.696)
Diagnostic Score Tests for:								
Functional form $[\chi^2(1)]$		1.20	0.09	0.00	0.06	2.74	2.75	2.77
Heteroskedasticity $[\chi^2(1)]$		2.34	1.43	2.17	1.57	0.80	0.81	0.78
Non-normality $[\chi^2(2)]$		25.64	29.53	32.41	31.44	10.35	11.06	10.61

Note: Sample: Male manual employees aged 21-64. sample size = 764. Standard errors in parentheses.