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Source: *The Journal of Human Resources*, Spring, 1995, Vol. 30, No. 2 (Spring, 1995), pp. 256-279

Published by: University of Wisconsin Press

Stable URL: https://www.jstor.org/stable/146119

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ABSTRACT

The reform of child support arrangements, including their treatment by the welfare system, has been on the policy agenda in a number of countries in recent years. This paper simulates the impact of a reform that recently has been implemented in the United Kingdom. The analysis is based on estimates of a model of discrete choice labor supply for a sample of U.K. lone mothers. We suggest that reform will induce a major reduction in welfare expenditures on lone mothers and a significant rise in their labor force participation due to greater work incentives associated with the changes.

I. Introduction

The number of lone parents has risen very rapidly in the United Kingdom in recent years. In 1991 there were estimated to be 1.30 million lone

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[Submitted October 1992; accepted December 1993]

parents representing 17 percent of all families with children,[1] compared to just 0.75 million 15 years earlier.

There are two distinctive features of the labor force behavior of lone mothers in the United Kingdom. Firstly, the labor force attachment of these women has *declined* considerably over the period which we analyze here, 1979–88, in contrast to the behavior of married mothers over the same period who have exhibited a strong increase in participation. Secondly, the proportion of lone mothers who work part-time is substantially lower than is the case for married mothers.[2]

The corollary of the falling labor force participation rate is that lone parents are of policy interest out of proportion to their numbers because of their growing relative importance as welfare clients.[3] However, despite the importance of this group, and the vast literature on labor supply modeling in general, there is relatively little multivariate econometric evidence on what determines their labor market behavior.[4] A knowledge of the wage and income sensitivity of labor supply for this group is of considerable importance for policy issues. In particular, in the face of dramatically declining levels of child support, recent legislation (U.K. Department of Social Security 1990) has been introduced to ensure that the level of child support is related to the needs of the caring parent and the ability to pay of the absent parent and that the payment of this level be subject to mandatory enforcement through a new government agency. A number of other changes are also proposed to the way in which the U.K. welfare system treats child support.[5]

It is well known that modeling labor supply is complicated by nonlinearities in the budget constraint, especially nonlinearities that result in nonconvexities. In the context of lone parents the nonconvexities associated with the welfare system and its overlap with the social security contribution and tax systems gives rise to extraordinarily complicated budget constraints. Thus, any analysis of the labor market behavior of lone parents needs to take on board the complicated nature of the budget constraints faced. Here we simplify the analysis by considering labor supply as a discrete choice problem involving a choice between a number of discrete alternative levels of hours of work.

The main features of the budget constraints faced by U.K. lone parents are given in Section II. In Section III of the paper we outline the econometric method-

1. See Haskey (1993) for estimates of the number of lone parents from a number of sample surveys including the Family Expenditure Surveys used here. Lone parents include widow(er)s, the divorced and separated, as well as never married (in other words, single) parents.

2. A comprehensive description of the labor market behavior of U.K. lone mothers drawn from the large Labour Force Surveys of 1981, 1984, 1987 and 1990 can be found in Bartholomew, Hibbett, and Sidaway (1992). The evidence there support the trends that we observe in the much smaller FES data.

3. See Brown (1989) for an overview of the welfare system relating to U.K. lone mothers and an interesting comparison across a number of countries.

4. See Jenkins (1992), Ermisch and Wright (1990), and Walker (1990) for estimates of models of participation in the United Kingdom. Ermisch and Wright (1993) estimate equations for participation and for full-time participation for all women. Blundell, Duncan, and Meghir (1991) estimate an hours equation for a subsample of U.K. lone parent taxpayers. See Hausman (1980) and Moffitt (1986a) for U.S. models of participation and hours of work. Fraker and Moffitt (1988), in particular, estimate a model of part-time and full-time labor force participation, Food Stamp, and AFDC participation.

5. This reform parallels the Child Support Enforcement Program introduced in the 1975 U.S. Social Security Act and subsequent legislation.

ology, and present the estimates. In Section IV we briefly outline the main aspects of the U.K. reform to child support and the welfare system, and demonstrate the implications of the estimates for the consequences of the reform. The conclusions are presented in Section V.

II. Labor Supply and the U.K. Welfare System

There are three main elements to the U.K. welfare system that are relevant to the labor supply choices of lone mothers which we outline briefly below.[6]

The Income Support (IS) system of social assistance provides a minimum income depending on the household's demographic profile and which also covers housing costs in many circumstances. The first component of IS (called *scale rates*) has changed little in real terms since 1978—indeed, it had been index linked (either to prices or earnings) for most of this period. However, the component which covers housing costs rose dramatically in real terms because of the large increase in mortgage interest rates and, especially, the large rises in real rents in the rental sector during the early 1980s. Note that IS is means tested against all forms of income (including child support payments) with a tax rate of 100 percent).[7] The U.S. AFDC is similar to IS which has no limit to duration of entitlement and has no requirement (for lone mothers) to be actively seeking work. Family Credit (FC) is a benefit whose value is proportional to the difference between a *prescribed amount* (which depends on the demographic composition of the household) and actual income, but can only be paid if hours of work are at least 24 per week. FC induces a *notch* in the budget constraint whose purpose is to counteract the disincentive effect of high IS entitlements. One can think of FC as a negative income tax with a work requirement. Finally, Housing Benefit (HB) is a means tested payment which depends on the demographic composition of the household and is related to the household's rent and local property tax (but does not cover mortgage payments) but is not typically paid to those on IS because the IS system compensates for housing costs at least as generously as HB.[8]

Figure 1 illustrates each of these elements. Unearned income is given by μ which includes child benefit (a lump sum per child payment) and any child support

6. See Ermisch and Wright (1990) for further details. Our data relates to 1979–88. In 1988 the U.K. welfare system was reformed and the names for some of the benefits were changed. The terminology here relates to the post-April 1988 welfare system. Income Support superseded Supplementary Benefit (SB); and Family Credit superseded Family Income Supplement (FIS). The general structure of the welfare system remained unchanged but the disregard of child care expenses that was a feature of the SB system was dropped from the Income Support scheme. Much further detail of the changes can be found in Dilnot and Walker (1989).

7. There is an earnings disregard of £4 per week and, since April 1980, half of the next £16 has been disregarded. Prior to 1988 reasonable child care expenses were also disregarded.

8. HB is means tested at a rate which depends on whether income is above or below some needs allowance, which itself depends on household composition. If income were exactly equal to the needs allowance then the amount of relief would be 60 percent of local property tax and, if applicable, rent but not mortgage interest.

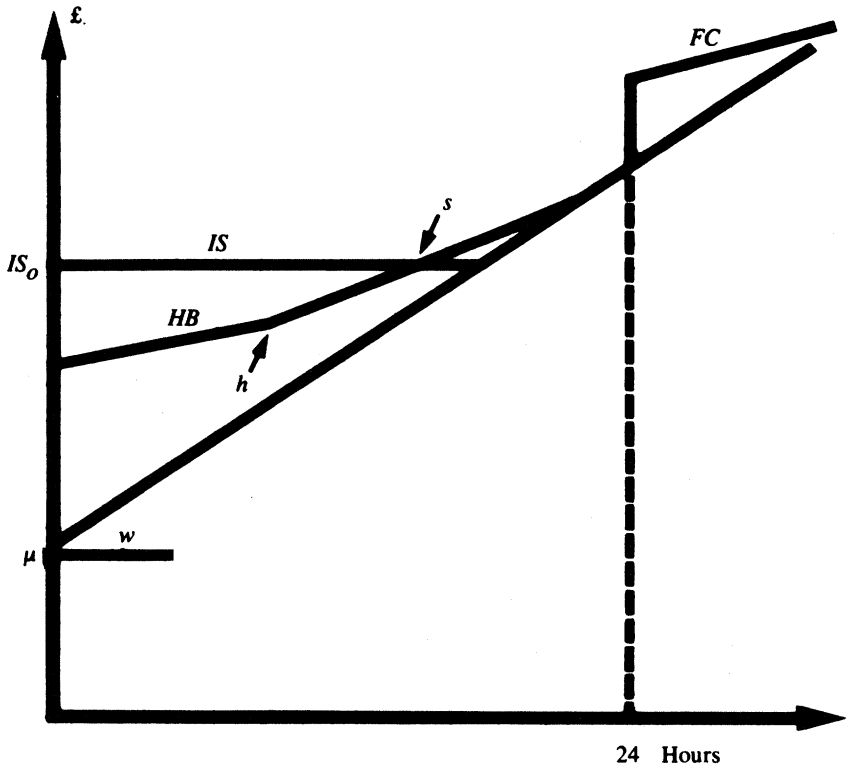

Figure 1
U.K. Welfare Schemes

payments, and the gross wage is w (which, in this figure, is assumed to be independent of h for the sake of simplicity) so the gross budget constraint is given by the heavy line. IS_0 is the IS entitlement at zero hours of work for this individual but IS is means tested at a 100 percent rate (above a small disregard) so IS entitlement is the vertical distance between the line labeled IS and the gross budget constraint. HB is given by the vertical distance between the line labeled HB and the gross constraint. Note that HB plus earned income dominates IS_0 at hours beyond point s. The HB line is kinked because the means test taper changes at point h. FC entitlement is the vertical distance between the FC line and the gross constraint. The figure is a simplification because the welfare system means tests against after tax income (net of social security contributions, which are called National Insurance Contributions, NICs, in the U.K.). Moreover, each welfare scheme is individually relatively simple but they interact in a complicated way. For example, FC is treated as income in the calculation of HB but HB is not relevant to the calculation of FC. The result is a complicated constraint with the potential for several notches as well as several nonconvexities.

The system is supposed to provide a minimum income (from IS) *and* provide

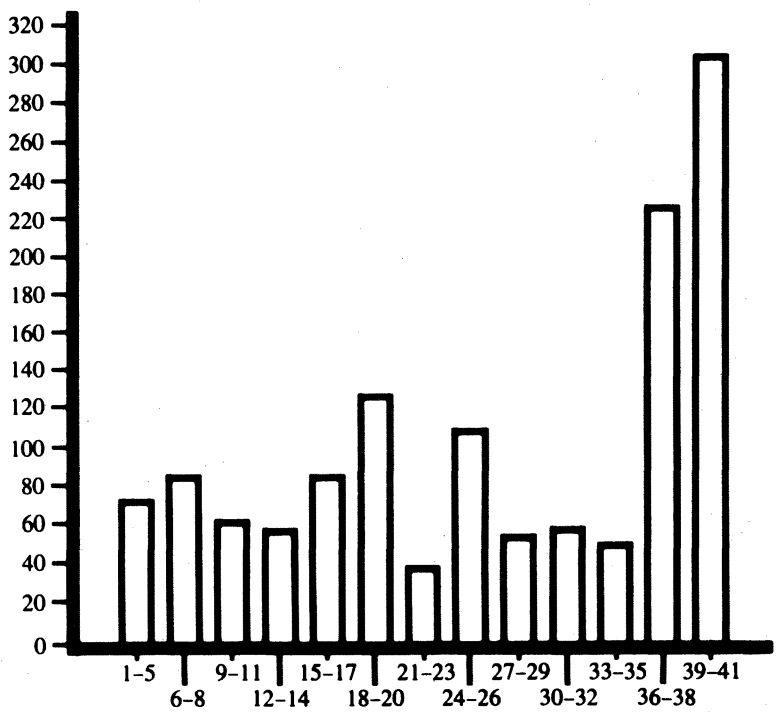

Figure 2
Hours Distributions
Source: FES tapes

an incentive to take low paid work (since FC is only paid if hours are 24 or more) and the role of HB was to overcome the adverse work incentive effect of IS's treatment of housing costs. Child support (CS) is treated as unearned income by all aspects of the tax and welfare systems with the exception that there is no NIC liability on child support (or on any other form of unearned income). We suspect that the disincentive to take part-time work will be severe because the operation of the welfare system will typically give rise to nonconvexity in the net (of tax and welfare) budget constraint. Nonconvexities in budget constraints tend to spread the hours distribution while convex constraints tend to generate bunching in the hours distribution. In Figure 2 we examine the hours distribution for the working sample and apart from the peak at full-time hours and at "round" numbers such as 15 and 20, the thinness of the distribution at low hours is only relieved by a small peak in the distribution at, and a little above, 24 where entitlement to FC occurs with corresponding troughs before 24 and then after 27 where earnings are getting sufficiently high that FC entitlement is beginning to cease and a further nonconvex kink occurs.

Figure 3 shows the proportions of lone mothers in nonparticipation (zero normal weekly hours and earnings), part-time (normal hours between 1 and 30 inclu-

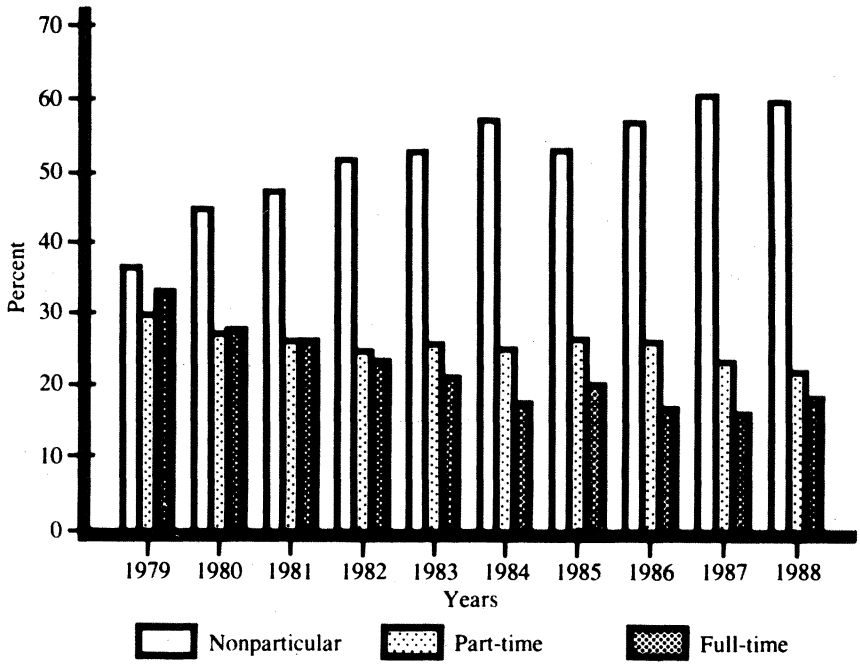

Figure 3
Labor Market Status over Time
Source: FES tapes

sive), and full time (hours at least 31). The figure shows very clearly the strong downward trend in labor force participation throughout the period as a whole, and the tendency for this to occur through a drop in full-time participation rather than part-time participation.

A number of other significant changes have taken place over time: the proportion receiving CS has fallen from 43 percent to 33 percent; the number of young children per household has risen from 0.24 to 0.39; the average age has fallen from 35 to 33; the proportion of widows has fallen from 12.7 percent to 8.3 percent; the real level of net income for nonparticipants in the labor force has risen by 29 percent while the average gross real wage has risen by only 26.6 percent; and the aggregate unemployment rate has more than trebled. These changes may well be expected to have changed labor force status over time. For example, lone mothers with young children are much less likely to participate.[9] The effect of CS is complicated. The group who receive CS are much more likely to work relative to the group who do not; while, for those that do work, CS is

9. Although, for married mothers the proportion of mothers with preschool children who work rose by a factor of three. There was also a major growth in all forms of child care facilities over the period although husbands remain the principal carer in households with working married mothers.

likely to result in part-time rather than full-time work being undertaken. Thus, there is a conventional negative income effect associated with CS when it comes to hours of work for participants, but CS has a *positive* effect on participation because of the absence of a disregard for it in the IS program.[10]

III. The Empirical Framework

Empirical analyses of labor supply behavior assume that individuals make choices about their participation and hours of work according to preferences described by a strictly quasi-concave differentiable utility function, $U = U(y, h; X)$ where X is a vector of characteristics that influence tastes; $y = w(h)h + m - T$ is net income; w is the gross wage which may depend on hours of work, h; m is gross unearned income; and $T = T(w(h)h + m; X)$ is the tax liability (net of welfare entitlement).

It is well known that estimating a labor supply equation using least squares in circumstances where the budget constraint is nonlinear results in biased and inconsistent estimates (see Moffitt 1986b). The structural approach to this problem depends on making welfare comparisons across all facets of the budget constraint. The practical difficulty that this implies in situations like the one considered here for lone parents is that a large number of such comparisons would be required to deal with the many potential nonconvexities. More importantly, MaCurdy (1992) demonstrates convincingly that ML methods force the estimates to be consistent with utility maximizing theory and in the very simple labor supply equations that are invariably adopted in structural models this imposes strong restrictions that may not be a feature of the underlying data. An alternative method is to instrument the (net marginal) wage. However, because there are usually no obvious exclusion restrictions, IV methods usually have to make arbitrary assumptions and Mroz (1987) has shown that labor supply estimates are quite sensitive to alternative assumptions. MaCurdy, Green, and Paarsch (1990) avoids both of these difficulties by approximating the post-tax budget constraint by a polynomial function of hours. However, MaCurdy, Green, and Paarsch have the advantage of working with the relatively *smooth* U.S. tax system while U.K. lone parents face a constraint that is much more irregular.[11]

In the face of the difficulties associated both with estimating a structural model and with taking a reduced form approach we adopt a compromise discrete choice model approach which does not impose a structural preference model and yet has somewhat more theoretical content than an entirely data driven instrumental approach.

Let the utility associated with choosing the hours level h_k be $U_i(y_k; X, h_k, \varepsilon_k)$ where ε_k is a random error associated with choice h_k. Then the utility gain from

10. Graham and Beller (1989) note a similar relationship for the U.S., despite the disregard for child support in the AFDC program, but attribute it to endogeneity of child support.

11. Blundell, Meghir, and Duncan (1992) estimate a flexible labor supply model using a "deep" selection of lone mothers who have more than sufficient income to face the standard tax rate and not be eligible for welfare benefits. This avoids the difficulties associated with nonlinear budget constraints at the cost of having to correct for the selection with its associated identification difficulty.

moving from h_k to h_j is

$$(1)\quad U_i(y_j; X, h_j, \varepsilon_j) - U_i(y_k; X, h_k, \varepsilon_k) \equiv U_{ij} - U_{ik},$$

where the subscript i denotes the individual, while j, k denote alternatives. In a discrete choice model the choices h_j and h_k are assumed to be common across i so this utility difference can be expressed as

$$(2)\quad U_{ij} - U_{ik} = g(y_{ij}, y_{ik})\delta_i + X_i\beta_{jk} + (\varepsilon_{ij} - \varepsilon_{ik}),$$

where $g(y_{ij}, y_{ik})$ is a row vector of differences of functions of the net incomes, and δ_i is an individual specific vector of parameters (which are constant across alternatives). The choice of $g(\,)$ is arbitrary. For example, $g(\cdot, \cdot)\delta_i$ could be quadratic

$$(3)\quad (y_{ij} - y_{ik})\delta_{i1} + (y_{ij}^2 - y_{ij}^2)\delta_{i2},$$

or any other function of a similar form. Adopting such a specification allows for some nonlinearity in income effects. Moreover keeping a linear form in the parameters δ enables us to introduce random parameters as described in Hausman and Wise (1978). In this case assuming that the error terms are jointly normally distributed and that the parameters are independently normally distributed is a natural choice and leads to tractable expressions for the probabilities. If one considers l such parameters we assume that $\delta_i = \bar{\delta} + \tilde{\delta}_i$, where $\tilde{\delta}_i \sim N(0, \Sigma_\delta)$, and $\Sigma_\delta = \text{diag}[\sigma_{\delta_1}^2 \sigma_{\delta_2}^2 \ldots \sigma_{\delta_l}^2]$. The model thus obtained belongs to the class of Multinomial Probit Random Utility Models.[12]

As usual in this class of model, only the utility differences between the number of alternatives minus one can be considered (see Pudney 1989 for a discussion). This results in the need for identifying restrictions on the variance covariance of the error terms $\varepsilon_{i,j}\ \forall j$. Therefore we parameterize the variance covariance matrix of the terms $(\varepsilon_{ij} - \varepsilon_{ik})$ such that the variance of $(\varepsilon_{i2} - \varepsilon_{i3})$ equals one.

It is possible to interpret the parameters β_{jk} as a gain (or a loss) in utility from having the characteristics X_i when one compares the alternative J to the alternative k, where this latter choice is the reference. The alternative j will be chosen by the individual i if

$$(4)\quad U_{ij} - U_{ik} > 0 \Leftrightarrow g(y_{ij}, y_{ik})\delta_i + X_i\beta_{jk} + \varepsilon_{ij} - \varepsilon_{ik} > 0, \forall k \neq j.$$

To obtain the probability of observing the alternative j we need to describe the correlation between the error terms $\eta_{i,jk} \equiv g(y_{ij}, y_{ik})\tilde{\delta}_i + \varepsilon_{ij} - \varepsilon_{ik}$. In the case of, for example, three alternatives we have

$$(5)\quad \text{Var}\left(\begin{bmatrix}\eta_{i,12}\\ \eta_{i,13}\end{bmatrix}\right) \equiv V_\eta = \begin{bmatrix}1 & \rho\sigma_{13}\\ \rho\sigma_{13} & \sigma_{13}^2\end{bmatrix} + \begin{bmatrix}g(y_{i1}, y_{i2})\\ g(y_{i1}, y_{i3})\end{bmatrix} \Sigma_\delta [g(y_{i1}, y_{i2})'\, g(y_{i1}, y_{i3})'],$$

12. Alternatively, a logistic distribution could be specified and the resulting model would be a multinomial logit. While the use of such a model would allow for a larger number of discrete choices to be considered we prefer to use the normal distribution and examine the results for their robustness in the face of alternative definitions of the choices.

where, ρ stands for the correlation between $\varepsilon_{i1} - \varepsilon_{i2}$ and $\varepsilon_{i1} - \varepsilon_{i3}$, and σ_{13}^2 stands for the variance of $\varepsilon_{i1} - \varepsilon_{i3}$. As a result of the normality assumptions made above, the probability of choosing the first alternative becomes

$$(6)\quad \text{Prob}[U_{i1} > U_{i2} \wedge U_{i1} > U_{i3}] = \text{Prob}[\{-(g(y_{i1}, y_{i2})\bar{\delta} + x_i\beta_{12}) < \eta_{i,12}\} \wedge \{-(g(y_{i1}, y_{i3})\bar{\delta} + x_i\beta_{13}) < \eta_{i,13}\}]$$

$$= \Phi_2\left[\frac{(g(y_{i1}, y_{i2})\bar{\delta} + x_i\beta_{12})}{\sqrt{\text{Var}[\eta_{i,12}]}}, \frac{(g(y_{i1}, y_{i3})\bar{\delta} + x_i\beta_{13})}{\sqrt{\text{Var}[\eta_{i,13}]}}, \frac{\text{Cov}[\eta_{i,12}, \eta_{i,13}]}{\sqrt{\text{Var}[\eta_{i,12}]}\sqrt{\text{Var}[\eta_{i,13}]}}\right].$$

and similar expressions apply for the other probabilities (for more details see Pudney 1991).

We define the choices h_k by discretizing the actual hours distribution whereby we allocate an hours level of h_k to all those individuals whose hours fall within a range around h_k. On the one hand this induces an errors in variables problem but on the other it allows for a nonstructural form approach to be taken. The larger the number of alternatives chosen the less the measurement error problem induced but the greater the computational complexity. Indeed, beyond three alternatives simulation methods for integration become necessary (see Keane and Moffitt 1992).

IV. Results

In order to address the determinants of labor force participation and welfare dependency the U.K. Family Expenditure Survey data sets were pooled over 1979 to 1988. The FES is the only U.K. source of data available for labor supply modeling and has been compared extensively with other sources of information and has been found to be reasonably reliable with some exceptions that are unlikely to be important in the present context.[13] Pooling the data over time has the advantage that the data has time series variation in the taxes and benefits as well as yielding a reasonable sample size to allow an econometric model of labor supply decisions to be estimated. The sample consists of 2,933 lone mothers and the sample selection criteria and some summary statistics are given in Appendix A.[14]

To operationalize the estimation procedure from Section III we need to specify the alternatives. Here we restrict ourselves to three alternatives which we define

13. See Atkinson, Micklewright, and Stern (1985). The major deficiency with the FES data that affects our analysis here is that the income data associated with the self-employed is thought to be unreliable. In the light of this problem we decided to exclude those working individuals who recorded positive self-employed income. This reduced our sample size by less than 5 percent.

14. The main difference between the labor market behavior of lone mothers and lone fathers is that the latter are unlikely to work part-time and given the relatively small dataset for fathers we focus here on the behavior of mothers.

on the basis of an inspection of the hours distribution so that the levels of h_k correspond to peaks in the distribution (0, 24, and 39) and the ranges around these are determined by troughs in the distribution (part-timers were defined as hours from 1 to 30 inclusive).[15] The levels of y_1, y_2, and y_3 for all individuals are computed from the wage relevant to each labor force state from data on individuals in each state. In principle one could estimate the parameters of the wage equations and the labor force status choices simultaneously using ML methods. However, this would require recomputing the tax and welfare relevant to each choice at each iteration and, given the complexities involved in these calculations for such a sample, this is not practical. Since we are only interested in getting consistent wage predictions we followed a two-step procedure whereby we estimate a reduced form ordered probit to generate the relevant hazards to include in wage equations for part-time and full-time work. The results are given in Appendix B. We find that there is strong evidence that the determination of wages for full-time workers is different from part-time workers and, like Ermisch and Wright (1993), we find some evidence of selection effects.

In order to address the question of the effects of economic opportunities on labor market behavior we need to compute exactly what these opportunities might be.[16] We use predicted gross wages to generate y_2 and y_3 via a complex tax/benefit program[17] which also computed y_1. We report below in Table 1 results for the RUM model.

The estimates suggest that income has an increasing concave effect on the attractiveness of a choice. The interpretation of the other coefficients is that a positive coefficient indicates a reduction in the attractiveness of that choice rela-

15. Given the difficulties in generalizing beyond three choices we also examine the robustness of the estimates to changes in the way which the choices are defined. In practice the estimates and the simulation results did not appear to be sensitive to small changes in the definitions of full-time and part-time providing part-time was defined as more than 23. Thus, 24 seems likely to be a critical value because it is the hours criterion in FC.

16. Given our reliance on the economic variables, y_1, y_2, and y_3 that underly the budget constraint, it is important to consider their exogeneity. In a lifecycle model of labor supply the level of unearned income, which is a small component of y_1, is clearly endogenous if individuals have access to a reasonably well functioning credit market. In the present context, it seems that this group of typically very poor, households are unlikely to be on their lifecycle paths and their prospects for having reasonable access to the credit market seems poor. For example, they typically would have little collateral to offer since the great majority of lone mothers live in rented accommodation. Thus, we use their recorded asset income data, rather than choose to instrument the observed difference between income and expenditure which would be suggested by a lifecycle model. See Blundell and Walker (1986) for further details.

17. The tax/benefit calculations were done using a program that has been under development for many years in the United Kingdom and which has been used extensively, both inside and outside government, to calculate the effects of tax and welfare reforms. It is widely regarded as incorporating best-practice use of the data for computing entitlements and liabilities. Details of the code are contained in Johnson, Stark, and Webb (1991). Policy analysis supported by this program typically do not contain behavioral equations, although Blundell, Meghir, Symons, and Walker (1988), and Blundell, Fry, and Walker (1988) are exceptions. The tax/benefit calculations took account of the scale rates and the housing component of IS (but not the associated free school meals, and other passported benefits); all aspects of HB; the FC system (again excluding school meals); the employee element of the NIC system; and the tax system including allowances associated with mortgage interest payments. It is assumed that individuals claimed the benefits to which they were entitled (and paid the tax to which they were liable) at the observed hours and that they would also do so at each of the alternative levels of hours.

Table 1
Random Utility Model Estimates

Variable	Nonparticipation versus Part-time		Nonparticipation versus Full-time
$y/100$ (£/week)		2.030	
		(0.32)	
$y^2/10{,}000$		−0.366	
		(0.09)	
Constant	−0.190		−0.399
	(0.29)		(0.25)
CS recipient	−0.333		−0.290
	(0.09)		(0.05)
Unemployment rate	0.863		−0.206
(percentage)	(0.97)		(0.84)
Household head	0.050		0.211
	(0.09)		(0.07)
Widow	0.068		0.177
	(0.09)		(0.09)
Youngest child 0–2	1.278		1.217
	(0.10)		(0.12)
Youngest child 3–4	0.789		0.895
	(0.10)		(0.11)
Youngest child 5–10	0.226		0.345
	(0.07)		(0.07)
σ_{δ_1}	0.000	σ_{13}	0.657
	(0.154)		(0.093)
σ_{δ_2}	0.089	ρ	0.953
	(0.053)		(0.017)
Mean log-likelihood		−0.8497	

Note: Age, region, and year dummies are included throughout and the coefficients are in Appendix B. 2,933 observations. Standard errors are in parentheses.

tive to nonparticipation. Thus, the house head dummy is included to capture the absence of other adults in the household who could potentially have provided informal child-care for the mother and this has the expected negative effect on both participation and full-time work. The CS dummy could capture a number of things which distinguish women who receive it from those that do not but which are unobservable in the data—for example, divorced women (who are more likely to receive CS) may behave systematically different from the never married, widowed, and separated women and this is not observed in the FES data. Notice that the level of CS is already included in the economic variables so an alternative interpretation of this CS dummy is that it captures the potential uncertainty that

may be currently attached to CS income.[18] CS receivers are significantly more likely to work which seems consistent with the uncertainty argument.[19] The widow dummy has a significant effect.

The variances of the random parameters are not significant whereas the variance and the correlation of the error terms are highly so. The correlation parameter, ρ, being close to one indicates a strong correlation between the difference of the utilities obtained for nonparticipation and part-time and the difference of the utilities for nonparticipation and full-time. This is robust to whether or not the parameters of the incomes function are considered as random.

The ages of the dependent children are clearly important and we attempt to capture this effect from conditional dummy variables which equal one if the youngest child is in each of a number of particular age ranges (relative to the omitted category where the youngest child in the household is in the 11+ category). If the youngest child is aged 0–2 then participation, both part-time and full-time, is very dramatically reduced although, conditional on participation, full-time work is not significantly affected. If the youngest child is aged 3–4 then participation is considerably reduced, and the effect on the full-time probability is a little larger than for part-time. If the youngest child is aged 5–10 (in other words, at primary school) then part-time, and especially full-time, participation are significantly reduced but by a smaller amount.

Goodness of fit measures in models such as this are fraught with difficulties.[20] McFadden (1974) suggests a pseudo-$R^2 = 1 - (\text{Log } L^0/\log L)$, where Log L^0 is the log-likelihood value when all parameters (except the intercepts) are zero. This pseudo-R^2 here takes the value of 0.20. In addition, it has been common to look at a comparison of the actual labor market status with that predicted by the estimated model, which is presented in Table 2. The figures in Table 2 allow us to compute a count R^2 goodness of fit measure as the proportion of correct predictions—49.8 percent in this case.

In order to interpret the implications of the coefficients we simulate the impact of varying the characteristics of a baseline individual (y_1 = £89.34, y_2 = £124.2, y_3 = £135.3, unemployment 10 percent, 1979, South East, age 28, nonwidower, not receiving CS, household head, youngest child 11+) and present the results in Table 3. Making any position 10 percent more attractive in terms of net income raises the probability of being at that point and lowers the probabilities elsewhere. Receipt of CS halves the probability of not working. Not being a household head reduces the probability of not working, while being a widow raises it. The probability of working is very sensitive to the age of youngest child.[21] The age

18. Jenkins (1992) finds that the regularity or otherwise of CS was very important while the level of CS was essentially insignificant.

19. There is the possibility that CS receipt, if not the level itself, may not be exogenous—women who are unlikely to work may be, say, less likely to receive CS. See Flinn and del Boca (1994) for a recent example of modeling the receipt of CS. The same point could be made with respect to the household head dummy.

20. See Pudney (1989) and Maddala (1983). A number of attempts at constructing goodness of fit measures have been made although there is fairly widespread dissatisfaction with their properties.

21. There is effectively no subsidized preschool child care in the United Kingdom formal care especially for the 0–2 range is expensive, and it seems likely that most lone mothers will not have good access to informal care.

Table 2
Model Fit

	Predicted Status			
Actual Status	Zero Hours	Part-time	Full-time	All
Zero hours	980	330	249	1,559
Part-time	338	251	157	746
Full-time	240	160	228	628
All	1,558	741	634	2,933

effect on full-time participation is negative, but age has essentially no effect on part-time participation. Participation falls over 1980–81 and rises thereafter. Regional effects on part-time participation are very minor compared to the effects on full-time participation.

In Table 4 we show the contribution of each of the variables to the changes in labor force status between 1979 and 1988. These are computed by taking the average values of all the variables in 1979 and changing each variable (or set of variables) to their average 1988 values in turn. The first and last rows give the model predictions in 1979 and 1988, respectively, and the intermediate figures show the marginal effect of each of the variables in turn. Table 4 confirms the importance of the year dummies which capture the important unobservable changes over time such as the changing composition of lone parents—these effects account for 12 of the 28 point rise in nonparticipation. However, Table 4 also shows that the increasing proportion of lone mothers whose youngest child is preschool has had an important impact on nonparticipation—a six-point rise. Note that around one quarter of the predicted increase in nonparticipation between 1979 and 1989 can be accounted for by the changes in the economic variables. A third important factor has been the decline in CS receipt.

V. Child Support Reform

The proportion of lone mothers who receive IS[22] *and* who receive CS has been falling dramatically. Recent legislation (DSS 1990) introduced, from April 1993, levels of CS that are related to the needs and resources of both parents, and created a CS Agency to enforce the payment of this support via wage withholding. Moreover, the legislation proposes to increase the work incentive effect associated with CS by introducing disregards into FC and HB *but not* in IS.[23]

22. We retain the post-1988 terminology in this section.
23. An additional work incentive is provided by the reduction in the minimum hours required to generate an entitlement to FC from 24 to 16 per week.

Table 3
Predictions of the Model Estimates

	Zero Hours	Part-time	Full-time
Baseline individual	15.97	34.86	49.17
y_1 + 10%	21.29	32.81	45.90
y_2 + 10%	13.71	40.63	45.66
y_3 + 10%	12.18	31.06	56.76
Unemployment 15 percent	16.81	32.96	50.23
Not household head	11.33	31.40	57.27
Youngest child 0–2	75.72	10.94	13.34
Youngest child 3–4	56.97	20.72	22.31
Youngest child 5–10	27.80	33.29	38.90
Age 18	14.86	34.88	50.26
Age 38	17.13	34.81	48.06
Age 48	18.35	34.74	46.92
Age 58	19.61	34.64	45.75
North	20.44	36.24	43.32
Yorks	21.29	34.65	44.05
Northwest	22.97	32.74	44.29
East Midlands	23.44	32.08	44.48
East Anglia	13.17	34.53	52.31
Southwest	24.16	33.63	42.20
Wales	26.82	32.19	40.99
Scotland	25.83	31.82	42.35
1980	15.97	34.86	49.17
1981	15.97	34.86	49.17
1982	10.41	36.96	52.63
1983	12.18	38.20	49.63
1984	12.38	38.52	49.10
1985	15.41	38.73	45.87
1986	14.04	39.27	46.69
1987	16.20	37.79	46.01
1988	19.67	36.39	43.94

In the United States, CS enforcement is provided for in the 1975 Social Security Act and subsequent legislation[24] and the main distinction is that there is a CS disregard in the United States which provides an incentive to cooperate with the enforcement service. In the United Kingdom there is no disregard in the IS system, rather the incentive is that an unreasonable unwillingness to cooperate with the CS Agency could result in the loss of some IS entitlement. However,

24. See, for example, Garfinkel, Robins, Wong, and Meyer (1989) for a brief description for the United States.

Table 4
Accounting for Falling Participation

	Zero Hours	Part-time	Full-time
Status in 1979	17.23	37.62	45.15
1988 year dummy	12.36	−4.29	−8.07
Regional dummies	0.86	−0.23	−0.63
Age dummies	−0.20	0.02	0.19
Child dummies	5.88	−2.69	−3.19
CS dummy	1.75	−0.81	−0.94
Widow dummy	−0.18	−0.07	0.25
Household head dummy	0.13	0.09	−0.22
Unemployment	0.69	−1.46	0.77
y_1, y_2, and y_3	5.90	−2.64	−3.26
1988 status	45.86	26.04	28.11

the U.K. legislation goes beyond enforcement by introducing larger CS entitlements and changing the treatment of CS within the welfare system.

The new CS formula introduces a *maintenance bill* to be "paid" by both the parents out of their disposable incomes (essentially after tax and housing costs) to the caring parent. Assessable incomes would be taxed at 50 percent up to the point where the maintenance bill were met.[25] The effect of such a policy should be to increase the net incomes of those not on IS but who currently receive little or no CS, and to increase the incentive for those on IS to work. For both reasons one would expect a considerable reduction in the welfare costs associated with lone parents and a reduction in welfare dependency. Thus, while the new arrangements might offer substantial increases in CS for those on IS, the effect on the net incomes for such individuals may well be small. In effect the disregards in FC and HB and the absence of a disregard in IS promote the incentive to work. Moreover, CS ought to become a more reliable source of income under the new enforcement regime and this may also encourage individuals with low prospective wages to work and take advantage of this reliable source of income.

The precise magnitude of the effect on labor market behavior and on government tax revenue and social security expenditures is an empirical question which requires very detailed data on the incomes of the absent parents as well as a labor supply model. In the absence of specific information about the earnings of absent parents in FES data we estimate an earnings equation for a sample of married men with children and a spouse present in the household where the explanatory variables are the characteristics of the wife (see Appendix B). This equation is used to predict the incomes of absent parents[26] which allows us to

25. Thereafter, assessable income would be taxed at 15 percent so that children could benefit from having a high income absent parent.

26. Garfinkel and Oellerich (1989) follow the same procedure. They find that their predictions for whites are just 2.1 percent below actual in a matched data file.

Table 5
Simulated Effects on Net Incomes, Revenue, and Labor Force Status

	All		CS = 0		CS > 0	
	Base	Post-reform	Base	Post-reform	Base	Post-reform
Net income at h = 0	106.43	111.78	106.58	110.39	106.04	115.49
Net income at h = 24	136.59	157.81	134.22	156.67	142.93	160.87
Net income at h = 39	150.81	170.05	145.40	166.06	165.24	180.68
Net revenue £ (constant status)	22.85	44.13	5.12	33.90	70.21	71.42
Nonparticipation (%)	59.70	61.70	65.01	63.42	45.52	57.12
Part-time (%)	23.53	16.15	21.68	16.00	28.46	16.55
Full-time (%)	16.77	22.15	13.31	20.58	26.02	26.33
Net revenue £ (predicted status)	22.85	39.75	5.12	28.06	70.21	70.96

Note: Figures are average £ per week per lone parent family.

compute the maintenance bill if we make a further assumption about the housing costs, and new domestic circumstances of the absent parent.[27]

Table 5 gives results of simulating the effects of the reforms over all of the individuals in the 1988 sample[28] using the probability expressions implied by the estimated discrete choice model. That is, the expected values of net incomes, tax payments, and welfare payments were computed for each individual. It is useful to distinguish between those that receive CS pre-reform (CS > 0) and those that do not (CS = 0). The top half of the table shows what happens to the budget constraint on average and gives the average of the net incomes, reflated to 1991, pre- and post-reform. Notice that the reform increases net incomes, on average, at all points especially for those individuals who currently do not receive CS when they work. For those that do not work the increased CS is mostly offset by a corresponding reduction in IS. We can use the computed levels of net income in each state to calculate government revenue by weighting the contribution each individual would make to the government (in other words, her tax payments minus her welfare entitlements) in each state by the probability of being in each

27. DSS expect the CS Agency to be able to collect CS for only half of those on IS and further research in this area is clearly called for. We assume that the absent parent is an employee who is taxed at 25 percent plus the NIC rate of 9 percent and we appeal to the U.K. empirical literature, which typically generates a close to perfectly inelastic male labor supply, to support our assumption that the reform will have no labor supply effects on absent fathers. The tax treatment of CS payments is that it is tax deductible up to £28 per week. In addition we assume that the absent parent lives in rented accommodation paying £40 per week, a figure used in some of the White Paper's examples. The absent parent is assumed not to have formed a second family.

28. The proportion of mothers in receipt of CS has fallen considerably and this makes it difficult to "age" the data and construct a sample that is representative of the present population from the history of pooled cross-sections. Thus, our simulation results here are based solely on the 1988 data (334 observations).

state. Thus, the net revenue figure for constant hours uses the pre-reform probabilities of being in each state to compute revenue contributions for each individual both pre- and post-reform. That is, these figures do not allow for the reform to have any impact on labor supply. Note that the overall increase in net government revenue (at constant hours) is largely due to the CS = 0 group. This group gets CS post-reform which correspondingly reduces the government's IS payments to them, while the CS > 0 group gets more CS on average and gets to keep most of it since few of this group are on IS.

The bottom half of the table shows the expected proportions of the sample in each labor force state—in other words, the average across all individuals of the probabilities of being in each of the labor market states.[29] For the CS = 0 group, the small increase in net income at zero hours that typically occurs tends to reduce participation but this, in practice, is more than offset by the larger increases in net income that occur at part-time and full-time work arising because of the incentive effect of the reform. Notice that the effect on participation for those currently receiving CS pre-reform is quite dramatic since these individuals now typically receive much larger amounts and they receive it with certainty. They respond by relying on it more heavily[30]—to an extent which offsets the effects of the increases in net income. For the CS = 0 group the reform attracts low wage women into full-time work and actually increases FC payments because of its CS disregard. Moreover, part-time women become entitled to more FC because of the reduction in the hours limit for FC entitlement. The pre- and post-reform probabilities can be used to weight the net incomes pre- and post-reform to allow for the effects of the reform on behavior as well as on the heights of the constraints.

The reform clearly transfers some of the cost associated with CS from the government to the absent parent. The revenue effects are computed by weighting the computed pre- and post-reform taxes and welfare entitlements by the corresponding probabilities for each individual and then averaging across individuals. The expected increase in net revenue is £16.90[31] per head per week. Thus, the analysis suggests that there would be a reduction in net government expenditure

29. While the model here predicts the probabilities of being in particular labor market states rather than the actual level of hours there is no reason for thinking that the approach will yield any worse predictions for either behavior or revenue than conventional hours modeling. Indeed, it is often observed that conventional models fail to capture the distinct peaks that do occur in hours distributions. It is important to note that the results below are based on expectations derived from the parameter estimates and the estimated variance/covariance terms and *not* based on assigning individuals (either pre-reform or post-reform) to particular hours levels.

30. That is, we set the CS dummy, which we interpret as picking up the uncertainty of CS income, to zero for all observations post-reform. Alternatively, one could treat the CS dummy as though it picked up some individual fixed effect. In this case the appropriate thing to do in simulation is to maintain CS at its pre-reform value. In this case the post-reform employment status for the CS > 0 groups becomes: NP = 46.95 percent, PT = 21.49 percent, and FT = 31.56 percent. The corresponding figures averaged over the whole sample is then: NP = 58.83 percent, PT = 17.51 percent, FT = 23.66 percent. This is a larger move towards participation than the case in Table 5. This arises because there it was assumed that all individuals have CS = 0 post-reform and the estimates were such that the CS dummy reduced both PT and FT participation.

31. This figure comes from subtracting the post-reform revenue from pre-reform.

close to £880 per annum per lone mother.[32] The net saving to the Exchequer is therefore likely to be in the order of £900 million per year since the legislation affects all nonwidowed lone parents, of which there is approximately one million.[33]

VI. Conclusions

This paper has been concerned with analyzing the impact of recent changes to U.K. child support (CS) using a labor supply model for lone mothers. The model is based on sample survey data from 1979 to 1988. Lone parents are distinctive in the United Kingdom as being eligible for Income Support (IS, the U.K. equivalent to AFDC) payments without having to satisfy an availability for work eligibility criterion. In order to take account of the very complex nature of budget constraints for this group and avoid the difficulty usually associated with estimating labor supply models in the face of such complexities we estimate a Random Utility Model of nonparticipation, full-time and part-time work.

The modeling concentrated on estimating the effects of the budget constraint, of demographic variables, and of CS. The results show that the labor market status of lone mothers is quite sensitive to the nature of economic incentives. The presence of young children has a large negative effect on the participation probability. CS was incorporated into the budget constraint but we attempted to see if there were any additional effect on the labor market behavior of those who receive CS from those who do not. We found that those who receive were more likely to work. This finding seems consistent with the argument that it is the uncertainty of current CS payments that is important—such an argument would suggest lower labor force participation might be a consequence of greater enforcement of CS orders. The model was used to simulate the impact of replacing the existing CS payments by amounts suggested by new legislation. Under this scheme CS payments would be means tested against the absent parents income (net of tax and various allowable expenses) and would depend on the needs (and means) of the caring parent. The new arrangements would be accompanied by new CS disregards in the Housing Benefit (a rent subsidy) and Family Credit (a negative income tax with a work requirement) programs but, importantly, *not* in IS. The estimates here were used to predict the impact of these changes on (expected) labor market behavior and government revenue and expenditures. The revenue impact amounts to a likely reduction in government expenditure of £900 million per annum (close to 2 percent of the total social welfare budget for the DSS).

32. In the case where the simulation was conducted using the observed values of CS post-reform the net revenue post-reform is increased by a further £1.93 on average implying a further saving in government revenue of £100 per person per annum.

33. These results should be treated with more than the usual amount of caution since they are derived from sweeping assumptions about the characteristics of the absent fathers. We also assume that the impact of the proposals on lone fathers will be negligible—either because they work full-time and would not be receiving any financial support from the DSS, or because they are widowers.

Appendix A

Data

The data are summarized in Table A1. Lone parents were defined as: women aged 16 to 59 with at least one dependent child aged 0 to 15 (or 17 if in full-time education), in a household which contained no other adults or where the other adults were defined as a blood relative of the lone parent. Thus, we exclude cohabiting couples but include lone parents who are not household heads. The data are in real terms at December 1988 prices. Other income is defined as all sources other than means-tested payments such as IS, FC, and HB, earnings, and maintenance payments. Thus, widow benefit, child benefit, and one-parent benefit account for the majority of other income.

Table A1
Lone Mothers

	79	80	81	82	83	84	85	86	87	88	All
Participation	63.4	55.0	52.5	48.1	46.9	42.5	46.7	42.9	39.4	40.1	47.8
Part-time	30.0	27.3	26.2	24.6	25.7	25.1	26.4	26.1	23.3	21.9	25.7
Full-time	33.3	27.7	26.2	23.5	21.2	17.5	20.3	16.8	16.1	18.3	22.1
Hours|H > 0	28.5	27.5	28.2	27.3	25.9	25.6	25.7	25.4	24.7	26.4	26.4
IS|IS > 0	52.03	49.82	59.33	59.88	46.46	43.77	43.40	44.37	45.46	47.24	49.21
Wage|H > 0	2.89	2.91	3.04	2.84	2.87	3.18	3.91	3.20	3.49	3.66	3.16
Children <5	0.24	0.26	0.33	0.38	0.40	0.43	0.39	0.52	0.47	0.51	0.39
Children 5–10	0.62	0.67	0.58	0.59	0.52	0.47	0.59	0.51	0.50	0.54	0.57
Children >10	0.68	0.72	0.87	0.70	0.68	0.72	0.67	0.59	0.56	0.51	0.67
CS rate	43.2	41.5	36.5	32.5	29.6	29.1	34.8	33.2	30.0	27.8	33.8
CS level|CS > 0	25.72	29.53	38.24	27.56	36.43	30.56	33.47	40.74	28.17	33.05	32.99
Other income	22.15	20.53	25.48	22.47	21.47	24.16	24.06	25.10	20.63	21.47	22.37
Widow	12.7	9.62	12.2	10.4	7.40	8.73	8.70	9.38	3.61	8.68	8.30
Renter	73.2	73.8	76.8	73.0	71.6	67.0	70.5	73.1	64.4	71.8	71.5
Mortgagee	15.0	18.1	16.0	18.3	20.7	23.2	20.7	19.4	27.2	19.4	19.8
Home owner	11.7	8.1	7.2	8.7	7.6	9.8	8.8	7.5	8.4	8.8	8.7
House head	86.9	85.8	86.7	88.2	86.8	86.2	88.0	89.2	88.3	89.5	87.4
Sample size	213	260	263	289	311	275	276	352	360	334	2,933

Note: Financial figures are £ per week, except for wages which are £ per hour. Characteristics are in percent.
Source: FES Tapes.

Table B1
Log Wage Equation for Lone Mothers

Variable	Ordered Probit	PT Wages	FT Wages
Constant	−1.255 (0.46)	−0.659 (0.40)	−1.079 (0.34)
$y_1/100$	−0.780 (0.09)	—	—
Education years	0.136 (0.01)	0.078 (0.012)	0.068 (0.01)
Age/10	0.660 (0.21)	0.094 (0.17)	0.590 (0.15)
$Age^2/100$	−0.934 (0.28)	−0.003 (0.02)	−0.071 (0.02)
Children 0–2	−1.29 (0.09)	0.047 (0.09)	−0.268 (0.09)
Children 3–4	−0.945 (0.10)	0.033 (0.07)	−0.256 (0.08)
Children 5–10	−0.424 (0.064)	0.005 (0.03)	−0.145 (0.03)
Children 11+	—	−0.001 (0.03)	−0.091 (0.03)
Renter	−0.393 (0.05)	−0.078 (0.05)	−0.228 (0.04)
Widow	−0.068 (0.09)	—	—
Child support	0.240 (0.05)	—	—
Southeast	0.065 (0.16)	0.087 (0.04)	0.192 (0.03)
$\hat{\lambda}$	—	−0.061 (0.07)	0.189 (0.08)
Log likelihood	−2,535		
$\bar{R}^2$		0.187	0.292

Note: Standard errors in parentheses. The child variables are conditional dummy variables in the Probit equation and numbers of children in the wage equations. All equations include year dummies.

Table B2
Earnings Equation for Married Men in 1987 FES

Variable	Coefficient	*t*
Constant	3.89	(27.2)
Wife's education	0.059	(9.37)
Wife's age − education	0.051	(11.6)
(Wife's age − education)^2	−0.0010	(10.4)
Renter	−0.364	(13.5)
Number of children 0–4	0.038	(1.17)
Number of children 5–10	0.023	(0.96)
Number of children 11–16	−0.030	(2.39)
Unemployment rate	−0.0097	(1.59)
Southeast dummy	0.173	(4.88)
Week trend	0.001	(1.26)
$\bar{R}^2$	0.21	

Table B3
Random Utility Model Estimates—Continued

Variable	Nonparticipation versus Part-time	Nonparticipation versus Full-time
Age	0.179 (0.41)	0.420 (0.36)
1980	0.174 (0.12)	0.189 (0.11)
1981	0.110 (0.13)	0.117 (0.11)
1982	0.146 (0.14)	0.212 (0.12)
1983	0.145 (0.14)	0.227 (0.12)
1984	0.209 (0.15)	0.345 (0.13)
1985	0.181 (0.14)	0.306 (0.13)
1986	0.248 (0.13)	0.370 (0.12)
1987	0.341 (0.14)	0.458 (0.13)
1988	0.285 (0.13)	0.304 (0.11)
North	0.029 (0.19)	0.114 (0.17)
Yorks	0.070 (0.18)	0.118 (0.16)
Northwest	0.142 (0.18)	0.134 (0.15)
East Midlands	0.135 (0.19)	0.160 (0.17)
West Midlands	0.190 (0.18)	0.199 (0.16)
East Anglia	−0.149 (0.21)	−0.144 (0.18)
Southeast	−0.051 (0.17)	−0.054 (0.15)
Southwest	0.120 (0.19)	0.209 (0.17)
Wales	0.209 (0.19)	0.247 (0.17)
Scot	0.198 (0.18)	0.218 (0.15)

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