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Teenage truancy, part-time working and wages

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Abstract. Part-time work whilst still in full-time education is common in many industrialized countries, and teenagers constitute a significant component of the work force in some sectors of the labour market. In Britain, in the early 1990's, some 60% of 16–18 year olds still in full time education also worked part-time. Although the determinants of teenager participation in the labour market have been studied previously (both in the United States and the United Kingdom), there remain a number of neglected questions. We address some of these in this paper, basing our analysis on data taken from the UK National Child Development Study. We first examine how teenagers divide their time between working and studying. We further analyse what explains teenage wages and labour supply. We utilise a rich set of variables describing parental background, as well as parents' labour force status and draw on information on physical stature to explain variations in wages.

JEL classification: I20, J20, J31

Key words: Teenage labour supply, educational attainment, teenage wages

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1. Introduction

Until recently, the employment of teenagers in full-time education has attracted little attention in labour market analysis; it has perhaps been assumed that such work – including paper rounds, shop work and baby sitting – has limited economic significance, and raises few major issues for either labour market or employment policy. Recent literature, however, has revealed this notion to be mistaken, indicating that not only is teenage participation widespread amongst those still in full-time education (Micklewright et al. 1994), but it also has implications for the sharing of income within the household (Dustmann et al. 1996a), and for school performance and school leaving decisions (Ehrenberg and Sherman 1986; Dustman et al. 1996b, c). Furthermore, there is evidence that differences in employment experience at ages below 16 have an impact on subsequent wages (Griliches 1980) and wage differentials later in life (Michael and Tuma 1984). Although a number of studies have examined the various consequences of working part-time by those still in full-time education, the subject is by no means fully explored. Two areas that have not, as yet, been addressed are firstly the implications of working part-time for truancy rates, and secondly the relationship between teenage part-time work and teenage wage rates.

The possible link between working part-time and truancy, if it exists, might give cause for concern amongst policy-makers. If there is evidence to suggest that teenagers who work are also likely to stay away from school, then this might suggest that the potentially beneficial skills that young people gain from such work experience at an early age might also have more worrying implications. In this paper, we examine whether truancy amongst 16 year olds is associated with longer hours of work by those still in full-time education.

Secondly, we examine the extent to which the wages of 16 year olds vary across individuals, and attempt to find reasons for the observed differences in wages. The determination of the pattern of wage rates in this part of the labour market may be somewhat distinctive. Intuitively, one might expect the wage profile of teenagers to be rather flat, since few of the teenagers will have acquired much work experience or any formal qualifications (the first set of public examinations are normally taken at age 16 in the United Kingdom). However, although teenage wages may be quite flat with respect to the usual human capital variables, variations could be explained by other factors, like physical appearance, or parental background variables. Some of the jobs done by 16 year olds are likely to be manual work, or work in the service sector, and physical factors may be used by employers as indicators for productivity. Informational factors may also be important in this part of the labour market, and teenagers' employment prospects and wages may be influenced, for example, by their parents' employment status, in that employed parents may be able to provide better information about job opportunities, and may provide a route to contact with potential employers.

The structure of the paper is as follows. Section 2 describes the data that we use to investigate teenage truancy, working and wages. In Sect. 3 we discuss the basic model, and derive the econometric specifications. Sec-

tion 4 investigates the factors which influence truancy amongst 16 year olds, paying particular attention to the relationship between working part-time and missing school. In Sect. 5 we look at the factors which explain differences in wages for 16 year olds.

2. Data and variables

The data that we use to estimate our models of truancy, wages and labour supply are taken from the National Child Development Study, a survey which followed a cohort of individuals born during one week in March 1958. We base our analysis on the information that was included in the third wave of the study (NCDS3), which was conducted in 1974 when individuals were aged 16 and still in compulsory full-time education (see Fogelman 1976) for a detailed description of the data). Although the data used for this study is some twenty years old, the NCDS provides a large amount of information which is not contained in more recent cross-sectional surveys. Also, UK data from the Family Expenditure Survey (FES) suggests that the real wages for this particular group of young people have remained constant over time. This observation conforms with evidence suggesting that over the past three decades real hourly earnings have increased for all except for those at the very bottom of the distribution (see Gosling et al. 1994). Given that working teenagers often have very little to offer to employers in terms of qualifications and skills, we would expect them to be concentrated in the lower percentiles of the wage distribution.

As well as containing much of the usual information that is collected in household or individual level surveys, NCDS3 also records extensive information about the respondents including their educational background, physical development, interests, working habits, and attitudes to school. This was collected from four sources – separate medical, individual, parental and educational questionnaires. We also match in some local area information derived from the 1971 decennial Census of Population, which we match with the local authority codes in NCDS.

We use a sub-sample of 3738 individuals included in NCDS3. This is considerably less than the original 18 500 sampled in 1958, reflecting the impact of substantial panel attrition and incomplete responses, and also our decision to delete all observations in Scotland (about 1000 individuals) because the education system is different. More than two thirds of the missing observations reflect the absence of one or more of the questionnaires, through lost contact or refusal. The remaining loss of observations arises because of incomplete information on some variables, especially household income.

Since we are combining information for each individual from a number of separate questionnaires, our estimation sample of 3738 is substantially less than the total number of individuals for which we have information on part-time labour force participation at age 16 (11 964 individuals), and on truancy (12 027 individuals). For the individuals for whom this information is recorded, we can observe the impact on participation and truancy rates of the subsequent narrowing of the sample through incomplete information on other variables, and we find that these effects are small. Average labour force participation across all individuals for whom this information was

given was 49%, compared with 52% in our estimation sample. Truancy rates were 48% in both the 12027 original observations and in the estimation sample.

One great advantage of using NCDS3 is that it is perhaps unique in containing details on the teenager's attendance at school. Specifically, the teenager was asked in the individual questionnaire whether he or she had stayed away from school when they should have been there. Although this variable does not strictly give a measure of truancy, it does give some indication of when the child had missed school. Furthermore, by drawing on information included in the child's Medical questionnaire on whether the cohort member had been ill during the last year, it is possible to control for missing school because of poor health in our models of truancy. Overall, some 48% of our sample had stayed away from school during the past year when they should have been there, with an equal rate of non-attendance amongst males and females (see Table 2).

We have information on whether the 16 year olds worked or not. Of those who were working, further questions were asked concerning both the number of hours worked per week and levels of weekly earnings. Both of these variables were recorded in a banded rather than continuous form, with the bands corresponding to those shown in Table 1 a and b.

Table 1 a. Number of hours worked per week

Category	All		Females		Males	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
None	1790	47.89	906	48.09	884	47.68
0–3	155	4.15	49	2.60	106	5.72
3–6	601	16.08	339	17.99	262	14.13
6–9	688	18.41	421	22.35	267	14.40
9–12	212	5.67	87	4.62	125	6.74
12–15	132	3.53	45	2.39	87	4.69
15+	160	4.28	37	1.96	123	6.63
Total	3738	100.00	1884	100.00	1854	100.00

Table 1 b. Earnings from part-time jobs

Category		All		Females		Males	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
None	0	1790	47.89	906	48.09	884	47.68
0–0.99	1	166	4.44	74	3.93	92	4.96
1–1.99	2	704	18.83	420	22.29	284	15.32
2–2.99	3	516	13.80	302	16.03	214	11.54
3–3.99	4	214	5.72	83	4.41	131	7.07
4–4.99	5	122	3.26	42	2.23	80	4.31
5–5.99	6	70	1.87	15	0.80	55	2.97
6+	7	156	4.17	42	2.23	114	6.15
Total		3738	100.00	1884	100.00	1854	100.00

Table 1 a and b show the breakdown of hours worked and earnings across all individuals, and for females and males separately. There appears to be very little difference in participation rates by females and males, with participation rates of just over 50% for both sexes (Table 1 a). Comparing the hours distributions, 16 year old males still in compulsory full-time education on the whole tend to work slightly longer hours than their female counterparts. Females are more concentrated in the range between 3 to 9 hours.

Given the slight tendency for males to work longer hours than females, it is perhaps not surprising that male earnings are higher than those of females. The earnings distributions show basically the same pattern as the hours distributions. Nearly one in five males earn more than 3 Pounds per week in 1974 prices, compared to only one in ten females. However, it is not immediately clear, given the banded format of the data, whether all of these differences in earnings are due to differences in the number of hours worked or whether differences in hourly wage rates also affect the observed distribution of earnings.

In explaining truancy, participation, wages and labour supply we draw on information provided in NCDS 3 about the cohort member, as well as that included about the individuals' family background and schooling. We further make use of regional data from the 1971 census and match into our sample information on local unemployment rates to capture demand side factors.

We use information about the individual concerning the cohort members' gender, their physical appearance in terms of height and weight, and their ability as measured in tests at the age of 7. This is one of a number of ability measures in NCDS, and has been chosen because it reflects the earliest systematic ability testing of the NCDS children; we prefer it to the test results conducted when the children were older on the grounds that it may be less 'contaminated' by the effects of their education.

The family background of the individual is also likely to have an impact on teenagers' labour supply decisions, as well as their tendency to play truant and the wages that they earn. Here we include information about the number of younger and older siblings, parental employment and variables reflecting the number of years spent in education for both the mother and the father.

In 1974 a selective system for secondary education was still in existence in a number of local authorities, running alongside a system of non-selective comprehensive schools in other areas. We thus have a series of dummies which reflect the type of school that the individual attended. These indicate whether the cohort member attended a grammar school (selective higher-ability state school), a "secondary modern" school (selective lower-ability state school), a special school (for special needs children), a comprehensive (non-selective state-run school) or an independent school (fee-paying, outside the state sector).

Finally we match into our data set information on the regional unemployment rate. This is intended to capture a number of macro-economic demand-side factors which might influence the employment prospects of young unskilled workers. Means and standard deviations for all of the explanatory variables, for the whole sample, and for males and females separately, are given in Table 2.

Table 2. Variables and descriptives

Code	Variable	All		Females		Males	
		Mean	SD	Mean	SD	Mean	SD
OLDSIB	No. of older siblings	0.42	0.65	0.41	0.62	0.43	0.67
YNGSIB	No. of younger siblings	1.21	1.24	1.20	1.25	1.22	1.24
LOGINC	Log of household income	3.86	0.39	3.85	0.42	3.87	0.37
PA-AGEFT	Age father left full-time education	4.01	1.74	4.01	1.72	4.01	1.76
MA-AGEFT	Age mother left full-time education	4.00	1.40	4.01	1.41	3.99	1.40
ABLE7	Ability aged 7	73.80	20.60	75.32	19.76	72.27	21.31
HEIGHT	Height in cm	166.11	8.66	161.28	6.33	171.01	7.92
WEIGHT	Weight in kg	57.05	9.71	54.69	8.44	59.44	10.32
UNEMPL	Unemployment rate local authority	4.93	2.10	4.96	2.13	4.90	2.08
EMPLMW	Married women employed in local authority	40.73	6.51	40.72	6.63	40.73	6.38
TRUANT	Playing truant	0.48		0.47		0.48	
PAWORK	Father working	0.90		0.89		0.91	
PAFARM	Father works on farm	0.02		0.02		0.02	
MAWORK	Mother works	0.69		0.68		0.71	
COMP	Teenager at comprehensive	0.52		0.51		0.53	
GRAMMAR	Teenager at grammar school	0.14		0.15		0.13	
INDEP	Teenager at independent	0.04		0.04		0.04	
SPECIAK	Teenager at special school	0.02		0.01		0.02	
DOCTORS	Attended doctor last year	0.64		0.68		0.59	
No. observations		3738		1884		1854	

3. Modeling truancy, hours worked, and wages

The three variables we seek to model in this paper, working part-time while still in full-time education, the wages received for that work, and playing truant, are all likely to be related to each other. There is an obvious connection between hours worked and truancy. The probability that an individual plays truant may be influenced by the number of hours worked part-time. Since unobserved heterogeneity may affect both decisions, hours worked are potentially endogenous in the truancy equation. Furthermore, wages are only observed for those who participate, and these individuals may be non-randomly drawn from the overall population. In turn, the number of hours worked should be affected by wages.

In the analysis to follow, we do not attempt to estimate a fully structural model. Instead, we concentrate on analysing two key relationships – firstly, the relationship between part-time labour supply (in terms of the number of hours worked per week) and truancy behaviour, and secondly, the determination of wage rates in part-time work, taking account of the participation decision. In looking at both issues, truancy and wages, we formulate the part-time labour supply decision as a reduced form equation, and concentrate our attention on the factors determining truancy behaviour and the pattern of part-time wages.

There are two major shortcomings with the variables we wish to explain. First, hours worked are available as a categorical variable only. Secondly, we do not observe wages, but only weekly earnings, and this information is likewise categorical. To deal with the first problem, we formulate the hours worked equation as a grouped regression model (see Steward 1983). To deal with the second problem, we calculate the bands for wages from the bands for hours worked and earnings, and estimate the wage equation likewise as a grouped regression model.

(i) Truancy and part-time labour supply

In modeling the relationship between part-time labour supply and truancy we formulate the labour supply equation as a reduced form equation for the number of hours worked. This takes the form of a Tobit-type model, in which it is assumed that the decision whether or not to participate in part-time work is linked to the decision concerning the number of hours worked. We then estimate the reduced form equation for hours worked simultaneously with the truancy equation, in which we allow hours worked to affect truancy.

Consider first the labour supply equation. For notational convenience, we omit the index indicating the individual

$$h^* = x_h'\beta_h + u_h;\ h = 3j \quad \text{if} \quad \mu_{j-1} < h^* \leq \mu_j,$$
$$\mu_{-1} = -\infty,\ \mu_j = 0.5 + 3j\ (j = 0, \ldots, 5),\ \mu_6 = \infty. \tag{1}$$

We observe hours worked in 7 categories $j = 0, \ldots, 6$ (see Table 1a for details). We generate the variable h, which makes the scale comparable to that of actual hours worked. The underlying latent variable is denoted by h^*, x_h is a vector of explanatory variables, and the μ_j are the thresholds for categories $j = 0, \ldots, 6$. We assume u_h to be normally distributed with mean 0 and variance σ_h^2. The model is similar to a Tobit model, except that h^* is not observed as a continuous variable over its positive range.

We observe the event of truancy as a binary variable. We relate this variable to a latent variable t^*, which may depend on h:

$$\mathrm{t}^* = x_\mathrm{t}'\beta_\mathrm{t} + \gamma_\mathrm{t} h + u_\mathrm{t}. \tag{2}$$

If unobserved heterogeneity affects both truancy and hours worked, then $\mathrm{Cov}(u_h, u_\mathrm{t}) = \sigma_{h\mathrm{t}} \neq 0$. To allow for correlation we estimate (1) and (2) simultaneously by maximum likelihood. We assume that u_h and u_t are jointly normally distributed, with variance σ_h^2 and σ_t^2 respectively. The likelihood contribution for individuals who play not truant, and who play truant are given by

$$\mathrm{L}_{(\mathrm{t}^* \leq 0)} = \Phi_2\left(\frac{\mu_j - x_h'\beta_h}{\sigma_h},\ \frac{-x_\mathrm{t}'\beta_\mathrm{t} - \gamma_\mathrm{t} h}{\sigma_\mathrm{t}},\ \rho_{h\mathrm{t}}\right)$$
$$- \Phi_2\left(\frac{\mu_{j-1} - x_h'\beta_h}{\sigma_h},\ \frac{-x_\mathrm{t}'\beta_\mathrm{t} - \gamma_\mathrm{t} h}{\sigma_\mathrm{t}},\ \rho_{h\mathrm{t}}\right) \tag{3}$$

and

$$\mathrm{L}_{(\mathrm{t}^*>0)} = \Phi_2\left(\frac{\mu_j - x_h'\beta_h}{\sigma_h}, \frac{x_\mathrm{t}'\beta_\mathrm{t} + \gamma_\mathrm{t} h}{\sigma_\mathrm{t}}, -\rho_{h\mathrm{t}}\right) - \Phi_2\left(\frac{\mu_{j-1} - x_h'\beta_h}{\sigma_h}, \frac{x_\mathrm{t}'\beta_\mathrm{t} + \gamma_\mathrm{t} h}{\sigma_\mathrm{t}}, -\rho_{h\mathrm{t}}\right), \tag{4}$$

respectively. Here Φ_2 denotes the bivariate standard normal distribution, and $\rho_{h\mathrm{t}} = \frac{\sigma_{h\mathrm{t}}}{\sigma_h \sigma_\mathrm{t}}$. The parameter σ_t is not identified, and we normalize it to 1.

(ii) Wage rates and part-time working

In analysing the relationship between wage rates and part-time work, we face the familiar problem that individuals may be selected non-randomly into the sample of part-time workers. We therefore estimate the wage equation simultaneously with the labor supply equation. Again, we specify the labour supply equation as a reduced form (in this case, simply as a binary participation decision), and so do not seek to analyse the effect of wages on labour supply.

As mentioned above, neither wages nor wage categories are observed directly. We observe both earnings and hours in banded form, and we construct from that information a wage band for each individual.

More concretely, let the index h represent hours categories, with $h = 3j$ if the unobserved number of hours worked, h^*, falls between the two thresholds μ_{j-1} and μ_j: $h^* \in (\mu_{j-1}, \mu_j), j = 1, \ldots, \mathrm{N}$. N is the number of categories for positive hours worked (which is equal to 6 in our case). Furthermore, define the variable E, with $\mathrm{E} = \mathrm{l}$ if the unobserved earnings variable $\mathrm{E}^* \in (\nu_{\mathrm{l}-1}, \nu_\mathrm{l}), \mathrm{l} = 1, \ldots, \mathrm{M}$. The respective band threshold for the earnings category is ν_l, and M is the number of positive earnings categories (which is equal to 7 in our case). From this information, we construct a wage band for each individual. The unobserved wage variable w^*, which is characterized by the hours category j and the earnings category l, falls into the constructed wage bounds according to $\mathrm{w}^* \in (\frac{\nu_{\mathrm{l}-1}}{\mu_j}, \frac{\nu_\mathrm{l}}{\mu_{j-1}})$. We obtain $\mathrm{N} * \mathrm{M}$ bands for wages.[1] For the estimations, we use the logs of these thresholds, which we denote by θ_k. This allows us to interprete the coefficients as percentage changes.

The unobserved index for the (log) wage variable w^* is related to these constructed categories as follows:

$$\mathrm{w}^* = x_\mathrm{w}'\beta_\mathrm{w} + u_\mathrm{w};\ \mathrm{w} = \mathrm{k} \quad \text{if} \quad \theta_{\mathrm{k}-1} < \mathrm{w}^* \leq \theta_\mathrm{k}. \tag{5}$$

If selection into employment is non-random, $\mathrm{Cov}\,(\sigma_h, \sigma_\mathrm{w}) \neq 0$. When analysing wages, we neglect information in (1) we have on the hours categories. We distinguish only between participating and non-participating, and estimate the participation equation and the wage equation simultaneously. The likelihood contributions for participants and non-participants are given by

$$\mathrm{L}_{(h^*>0)} = \Phi_2\left(\frac{x_h'\beta_h}{\sigma_h},\ \frac{\theta_{\mathrm{k}} - x_{\mathrm{w}}'\beta_{\mathrm{w}}}{\sigma_{\mathrm{w}}},\ \rho_{h\mathrm{w}}\right) - \Phi_2\left(\frac{x_h'\beta_h}{\sigma_h},\ \frac{\theta_{\mathrm{k}-1} - x_{\mathrm{w}}'\beta_{\mathrm{w}}}{\sigma_{\mathrm{w}}},\ \rho_{h\mathrm{w}}\right), \tag{7}$$

and

$$\mathrm{L}_{(h^*\leq 0)} = \Phi\left(\frac{-x_h'\beta_h}{\sigma_h}\right), \tag{8}$$

respectively. Here $\Phi(.)$ is the standard normal distribution, and $\rho_{h\mathrm{w}} = \frac{\sigma_{h\mathrm{w}}}{\sigma_h \sigma_{\mathrm{w}}}$. Because we only distinguish between participants and non-participants, σ_h is not identified in this model, and we normalize it to 1.

(iii) Identification

To identify non-parametrically $\rho_{h\mathrm{t}}$ (the correlation between the hours worked and truancy equations) and $\rho_{h\mathrm{w}}$ (the correlation between wages and participation decision), we have to impose exclusion restrictions on x_{t} and x_{w}.

In the former case, we argue that it is unlikely that truancy is affected by local labour market indicators if we condition on the labour force status of the parents. Drawing on information from the 1971 census, we use the unemployment rate and the percentage of married women participating in the labor force at local authority level as instruments. The local authority data which we have been able to match into NCDS covers around 500 separate areas, and therefore relates to quite narrowly-defined labour markets rather than broad regions.

To identify $\rho_{h\mathrm{w}}$, we exclude from the wage equation, besides the two local labour market indicators, the number of younger and older siblings, and the log income of the household. The number of siblings may reflect that there is more competition for resources inside the household, thus forcing children to work part time; however, siblings should not affect wage rates in a direct way. Likewise, family income, conditional on the labour force status and education of the parents, would be unlikely to have a direct effect on teenage wage rates.

4. Truancy and working

We begin by analysing labour supply and truancy. We estimate labour supply equations and truancy equations for all individuals in the sample, and for females and males separately. Table 3 presents results for the labour supply equation, and Table 4 for the truancy equation. The results refer to simultaneous estimation, and the likelihood values and correlation coefficients are given in Table 4. For comparison, estimation results for the single estimation of the truancy equation are presented in Table A1 in the appendix.

Table 3. Labour supply

Variable	All		Females		Males	
	Coefficients	*t*-statistics	Coefficients	*t*-statistics	Coefficients	*t*-statistics
CONST	5.732	2.96	5.382	2.31	4.407	1.39
OLDSIB	0.201	0.88	0.379	1.34	–0.007	–0.02
YNGSIB	0.680	5.59	0.483	3.18	0.912	4.63
PAWORK	0.937	1.62	1.412	2.02	0.320	0.33
MAWORK	1.175	3.28	1.126	2.60	1.276	2.16
PAAGEFT/10	–3.317	–3.00	–2.085	–1.51	–4.668	–2.66
MAAGEFT/10	–1.751	–1.32	–1.489	–0.91	–1.991	–0.92
LOGINC	–0.285	–0.61	–0.819	–1.50	0.434	0.54
COMP	–0.494	–1.38	–0.136	–0.31	–1.015	–1.74
GRAMMAR	–1.539	–2.89	–1.199	–1.88	–2.129	–2.44
INDEP	–5.929	–6.67	–4.023	–3.93	–8.161	–5.31
SPECIAL	–4.467	–3.74	–4.685	–2.59	–4.463	–2.61
PAFARM	1.241	1.37	–2.293	–2.02	5.996	3.78
ABLE7/10	0.284	3.53	0.326	3.17	0.254	1.99
DOCTORS	0.932	2.97	0.743	1.86	1.001	2.02
FEMALE	–0.965	–3.15				
UNEMPL	–0.587	–7.41	–0.569	–5.87	–0.597	–4.73
EMPMW/10	–0.688	–2.83	–0.541	–1.84	–0.783	–1.99
No. observations	3738		1884		1854	

Table 5 presents the marginal effects of hours worked on truancy, calculated for the average individual in the sample, both for simultaneous estimation, and for single estimation of the truancy equation.[2]

We turn first to the reduced-form equations for part-time hours of work in Table 3. Amongst the possible determinants of part-time work by teenagers in full-time education, we might expect that there could be both "demand-side" and "supply-side" influences. On the side of labour market demand, part-time work might be affected by the state of the local labour market and the sectoral structure of local employment (since teenage employment opportunities are likely to be concentrated in a limited number of low-skill activities requiring employment flexibility, such as shop work, hotels and catering, etc.). Influences from the side of labour supply might include various factors affecting the teenager's perception of the costs and benefits of part-time work, including the gains in terms of income and work experience, set against the costs in terms of the diversion of time from school work and other activities, and the search costs involved in finding a part-time job. The role of income in affecting teenage labour supply may be complex; both individual and family incomes may be relevant, and participation could be affected by the "sharing" rule, determining the teenager's benefit from, and contribution to, overall household incomes.

Not all of these possible influences can be captured by the variables available in our data set. We can, however, observe a significant effect of labour market conditions on the labour supply; a higher unemployment rate in the local area is associated with a lower probability of participation. It is interesting, moreover, that the negative impact of unemployment is also ob-

Table 4. Truancy equation, simultaneous estimation

Variable	All		Females		Males	
	Coefficients	*t*-statistics	Coefficients	*t*-statistics	Coefficients	*t*-statistics
CONST	0.225	0.95	0.143	0.44	0.302	0.87
OLDSIB	0.094	2.85	0.049	1.04	0.124	2.59
YNGSIB	0.007	0.39	0.044	1.73	–0.020	–0.74
PAWORK	–0.200	–2.41	–0.251	–2.19	–0.155	–1.25
MAWORK	–0.002	–0.03	0.007	0.10	–0.013	–0.17
PAAGEFT/10	–0.297	–1.91	–0.234	–1.06	–0.422	–1.91
MAAGEFT/10	–0.500	–2.73	–0.617	–2.41	–0.383	–1.44
LOGINC	0.030	0.45	0.024	0.27	0.060	0.60
COMP	0.044	0.87	0.021	0.30	0.044	0.60
GRAMMAR	–0.347	–4.45	–0.328	–3.06	–0.381	–3.38
INDEP	–0.470	–3.43	–0.467	–2.48	–0.545	–2.75
SPECIAL	–0.361	–2.22	–0.006	–0.02	–0.654	–3.00
PAFARM	–0.215	–1.46	–0.256	–1.32	–0.011	–0.04
ABLE 7/10	–0.025	–2.24	–0.017	–1.00	–0.031	–1.98
DOCTORS	0.184	4.04	0.164	2.47	0.220	3.55
FEMALE	0.010	0.22				
HH	0.039	2.00	0.063	2.16	0.005	0.20
S 1	8.216	48.79	7.151	33.22	9.239	34.97
Rho	–0.073	–0.63	–0.237	–1.37	0.172	1.03
Log-likelihood	–8287.6		–4109.8		–4132.0	
No. observations	3738		1884		1854	

Table 5. Marginal effect, hours worked

All		Females		Males	
ME	*t*-statistics	ME	*t*-statistics	ME	*t*-statistics
Single estimation:					
0.010	6.98	0.007	2.99	0.012	5.97
Simultaneous estimation:					
0.015	2.03	0.024	2.10	0.004	0.12

servable at the household level. Female teenagers from a household where the father is working are significantly more likely to have a part-time job, and both male and female teenagers are more likely to work part-time when the mother is working. Contrary to the view that adverse family circumstances might force teenagers prematurely into the labour market, and so to neglect longer-term educational objectives, there is in fact no indication that a household where parents are unemployed is more likely to have working teenagers. Both labour market conditions and, perhaps, the lack of contact with potential employers which working parents can provide may reduce teenage working by the children of the unemployed.

There is, likewise, little indication of a strong relationship between family income and part-time work by teenagers; for males and females the sign on the household income variable differs, and neither coefficient is significant. This corresponds with findings from other studies (including Micklewright et al. (1994), using data from the Family Expenditure Survey). As Dustmann et al. (1996a) show, the aspect of family income that is of most significance in explaining teenage participation is not the level of income, but the rule by which it is shared with the teenager – the "pocket money" decision. The number of brothers and sisters may also be relevant here; more brothers and sisters might make it more difficult for parents with a given family income to afford to make generous transfers to the teenager. Table 3 shows that the number of younger siblings is positively related to labour supply, which would be consistent with this suggestion, but that participation is not affected by the presence of older siblings (perhaps because older siblings may already be working, and may therefore have less need for parental transfers).

The measure of ability at age 7 has a significant and positive effect on labour supply of both males and females. More able teenagers are presumably able to compete better in the labour market for part-time work, as in other labour markets. This effect appears to outweigh any concern that more able teenagers may have about the possible adverse effect that long hours would have on their school work and examination prospects.

There are, however, significant differences in labour supply which arise from the type of school attended. By comparison with the base – secondary schools in a selective system from which more able pupils may attend grammar schools – males attending the other types of school were less likely to have part-time work (although the coefficient on comprehensive schools is not significant); in some cases this may reflect the attitude or "culture" of the school (selective-entry grammar schools may have encouraged pupils to concentrate on school work), or the length of the school day (many independent schools teach on Saturdays, unlike state schools), or otherwise unobservable characteristics of the individual (the special schools variable). The differences in part-time working between school types were also present amongst females, though smaller, and, in the case of both comprehensive and grammar schools, not significant. One reason for these differences could be that parents and schools placed less pressure on girls than on boys to concentrate on school work.

We now turn to the truancy equation in Table 4. As mentioned in the introduction, the data contains information on whether at some time during the past year the teenager had been absent from school, when they should have been present. We code this information as a (0-1) variable, taking the value one if the teenager was absent over the last year.

The survey does not explicitly differentiate between absence due to ill-health and absence through truancy, and we note that, in any case, there may be an imprecise boundary between the two types of absence. However, to control for absences that reflected genuine sickness, we included a variable (DOCTORS) which measures whether the individual had consulted a doctor at any time over the last year. This is significant in each of the estimated equations. However, it should be borne in mind that it may, to some extent, misclassify as sickness some cases of truancy, if some truants

seek to be excused from school on medical grounds even when the primary reason for their absence is simply an unwillingness to attend.

In considering the determinants of truancy, we might expect that truancy rates would reflect both "rational" and "cultural" factors. Amongst the former we note, in particular, the lower rates of truancy amongst more able pupils, who, presumably, perceive themselves as having more to lose through truancy.

We also note a range of effects associated with the presence of brothers and sisters in the household. Males (though not females) seem more likely to play truant when there are older brothers or sisters in the household, but a similar effect on male truancy is not observed from the presence of younger siblings. It is possible that 16-year-olds with older brothers or sisters are more likely to be led astray by, or to imitate, older teenagers, who may already have left school. Females, on the other hand, are affected differently by the presence of siblings. No effect on female truancy is observed from older siblings, but a weakly-significant effect is found where younger siblings are present, which might, for example, occur if girls took time off school to look after younger children in the family.

A similar effect might be expected where parents, especially the mother, are working, but the mother's labour force participation does not appear to affect truancy in either direction. Truancy rates appear to be increased where the father is not working. Parental education levels appear to be negatively related to truancy. No effect is found of household income on truancy levels.

As in the part-time work reduced-form equation, the school type variables enter strongly. Truancy is substantially less likely in grammar and independent schools than in the base case of selective lower-ability "secondary modern" schools, but there is no statistically-significant difference in truancy probability between all-ability comprehensive schools and the base case.

Lastly we turn to the main focus of this section, the relationship between part-time work and truancy levels. In the truancy equation we include as a measure for hours worked the variable *h*, which is defined above. We find that the probability of playing truant increases with the number of hours worked overall, though when we split the sample we find that this effect is significant for females only. Part time work therefore seems to have a negative effect, for females at least, on school attendance.

In the estimates shown here we are assuming that the relationship between truancy and hours worked is linear. We have tested the effect of relaxing this linearity assumption by estimating a version of the model using dummy variables for the hours categories. Using a likelihood ratio test, the assumption that hours enter in a linear fashion could not be rejected (at a significance level of 5% on a two tailed test).

Comparison the simultaneous estimation in Table 4 with the single-equation estimates in the Annex, we can see considerable differences in the estimated effect of part-time hours of work on truancy. As Table 5 shows, endogenising hours worked in the truancy equation leads to some increase in the size of the marginal effect of work on truancy in the overall sample, whilst reducing the significance of the coefficient. For females the rise in the coefficient is large, with little loss in significance, whilst for males, the

coefficient falls and loses any significance. Inspection of the correlation coefficient shows that unobserved characteristics which increase the tendency of males to participate in the labour market increase at the same time the propensity to be truant. For females, this correlation goes in the opposite direction, and this explains the rising impact of hours worked on truancy if controlling for endogeneity.

5. Wages of 16 year olds

Table 6 presents results on wages, where participation and wage equations are estimated simultaneously. Wage equations are reported for the whole sample, and for male and female teenagers separately. In none of the specifications is the correlation coefficient significantly different from zero. The set of instruments is significantly different from zero in the participation equation (reported in Table 8 of the annex).

The variables which have significant coefficients in the wage equations fall into two categories – variables reflecting the characteristics of the individual (gender, ability and – weakly – height), and variables reflecting the employment, education and occupation of their parents. In interpreting the size of the coefficients, it may be recalled that the wage thresholds were transformed into logs, so that the coefficients can be interpreted as they would be in a log wage regression, as the percentage change in wages for a unit change in the respective variable.

Table 6. Wage equations

Variable	All		Females		Males	
	Coefficients	*t*-statistics	Coefficients	*t*-statistics	Coefficients	*t*-statistics
CONST	–1.501	–4.45	–0.887	–1.67	–2.005	–4.33
HEIGHT/100	0.360	1.76	–0.020	–0.06	0.587	1.94
WEIGHT/100	0.068	0.46	–0.013	–0.06	0.071	0.31
PAWORK	0.000	0.01	–0.002	–0.05	0.013	0.17
MAWORK	0.083	0.78	0.018	0.44	0.160	3.60
PAAGEFT/10	0.247	2.56	0.311	2.80	0.155	0.92
MAAGEFT/10	–0.108	–0.91	–0.145	–0.97	–0.096	–0.51
COMP	0.004	0.15	0.008	0.23	–0.015	–0.32
GRAMMAR	0.046	0.99	0.021	0.39	0.058	0.73
INDEP	–0.098	–0.73	–0.113	–0.77	–0.177	–0.68
SPECIAL	–0.148	–1.25	–0.100	–0.62	–0.226	–1.25
PAFARM	–0.172	–2.69	–0.199	–1.55	–0.115	–1.13
ABLE 7/10	–0.031	–4.49	–0.029	–2.93	–0.031	–3.10
FEMALE	–0.083	–2.73				
S	0.436	31.65	0.377	17.63	0.486	31.67
Rho	0.186	0.78	0.226	0.62	–0.082	–0.25
Log-likelihood	–3986.4		–1888.5		–1065.2	
No. observations	3738		1884		1854	

We have argued earlier in the paper that it might be expected that the wage profile of teenagers would be quite flat; large differences in wage rates between the individuals in our data set would be unlikely, because the 16 year olds we are studying have not yet obtained any formal qualifications, and will have, in the main, little in the way of work experience. In Table 6, however, we do find some differences in wage rates which can be traced to differences in those individual characteristics which we do observe for the teenagers themselves – especially their gender (wage rates are lower for females), their measured ability (based on the tests at age 7), and, with weak significance for males only, their physical stature and development (measured by height).

The influence of ability in wage rates in the results in Table 6 is surprising; for both males and females the effect is negative and significant (with coefficients of similar magnitude). Amongst those who work, therefore, more-able teenagers appear to command lower wage rates. One possible reason which could explain this is that teenagers who are more able may be perceived by employers as less likely to remain in the job permanently; employers may not see any need to pay higher wages in order to discourage able teenagers from leaving, but may wish to pay higher wages to retain those less-able teenagers whose performance in the job is satisfactory. Also, it is possible that some of the less-able teenagers may have sought out and obtained jobs which they intend to move to, full-time, when they leave school; they may have been more willing to bear the higher search costs involved in obtaining "adult" rather than teenage jobs, which may be more difficult to find, but which may command higher wage rates than typical teenage part-time jobs.

The inclusion of data on physical measurements of height and weight is an unusual feature of these wage equations, but we suggest that here it has some rationale, as physical development may be relevant to teenage employment in at least two possible ways. First, for certain jobs, physical development and strength may be a feature in successful performance of the job; manual jobs involving physical strength would therefore only be available to those teenagers with more advanced physical development. Second, physical development may influence employers in selection; teenagers with a more "adult" appearance may be more likely to be selected by employers for jobs in which they work alongside other adults. For both these reasons, whilst we do not expect that height or weight would have any systematic effect on hours of work, we suspect that there could be an influence on wage rates; in the former case, this would reflect wage differences between manual jobs requiring strength and those not requiring strength, whilst, in the latter case, it might reflect wage rate differences between "adult" jobs and those available to less physically-mature teenagers.

In Table 6, the influence of physical characteristics on wage rates is found to be quite modest. Only the "height" variable has an effect which approaches statistical significance, and then only in the explanation of male wage rates. The effect is small; an increase in height of 8 cm (one standard deviation) would be associated with a 4% increase in the male wage rate.

The equation includes a number of variables reflecting the employment, education and occupation of the teenager's mother and father. Whether the father is working or not does not appear to affect wage rates, but working

mothers appear to have a significant positive effect on the wage rates of male teenagers, but not of females. The effect of the mother's employment might normally be thought to reflect lower search costs, in that working mothers may be able to provide information about teenage job opportunities, but it is then perhaps paradoxical that the effect is observed on male teenage wage rates, but not on female wage rates. The age at which the father left school is found to have a significant and positive effect on wage rates for both boys and girls. Finally, one occupational variable with a statistically-significant effect is reported: wage rates are much lower for children whose father is a farmer. This could reflect lower wage rates in rural areas more generally, or it may be because work on the family farm is paid at lower rates than in more arms-length employment relationships.

6. Conclusions

In this paper we analyse some aspects of labor force participation by teenagers still in full-time education, drawing on a rich data set for the United Kingdom. We are concerned in particular with two issues – the relationship between such part-time work and truancy, and the determination of wage rates for part-time workers who are still in full-time school education. In both cases we model the labour supply decision as a reduced form, estimating this simultaneously with the relationships of primary interest in the paper – firstly with the truancy equation and secondly with the wage equation.

The results for the reduced form for labour supply, whilst not the main focus of the paper, are nevertheless of some interest. We find, in particular, that family incomes do not have any effect on participation, and that if the teenager's parents are unemployed this has a negative effect on part-time labour supply. Part-time work is also reduced where local labour market conditions are weak. It would therefore seem that one stereotypical image of part-time work by school children – that it reflects a response to adverse family circumstances – is wrong. Indeed, it seems more likely that patterns of part-time working are influenced heavily by informational factors. Working parents may provide useful information and contact with employers, and success in the part-time labour market may then reinforce existing inter-household differences in circumstances.

With regard to truancy, our principal conclusion is that part-time work significantly increases the probability of truancy, for both males and females. However, when endogenising hours of work within the truancy equation, we find that the significant effect is confined to females only.

The influence of individual measured ability on truancy is negative, and we suggest that more able pupils may perceive themselves as having more to lose through truancy. Male truancy is adversely affected by the presence of older siblings in the household (perhaps imitation of older, unemployed, brothers and sisters), and female truancy is higher where younger brothers and sisters are present (perhaps reflecting child care activities). We also find that truancy is increased by the unemployment of the father, that truancy is negatively related to the parents' education level, and that there are various effects on truancy from the type of school attended. No effect is found of household income on truancy behaviour.

Table A1. Truancy, single estimation

Variable	All		Females		Males	
	Coefficients	*t*-statistics	Coefficients	*t*-statistics	Coefficients	*t*-statistics
CONST	0.269	1.18	0.292	0.95	0.221	0.64
OLDSIB	0.095	2.88	0.059	1.25	0.127	2.66
YNGSIB	0.011	0.69	0.057	2.40	–0.033	–1.38
PAWORK	–0.195	–2.36	–0.222	–1.99	–0.157	–1.25
MAWORK	0.006	0.12	0.038	0.55	–0.030	–0.41
PAAGEFT/10	–0.320	–2.12	–0.288	–1.35	–0.356	–1.66
MAAGEFT/10	–0.509	–2.79	–0.657	–2.61	–0.367	–1.38
LOGINC	0.031	0.46	0.012	0.14	0.050	0.50
COMP	0.038	0.77	0.013	0.18	0.064	0.91
GRAMMAR	–0.361	–4.85	–0.373	–3.67	–0.347	–3.13
INDEP	–0.508	–4.15	–0.573	–3.32	–0.449	–2.50
SPECIAL	–0.393	–2.53	–0.119	–0.50	–0.588	–2.80
PAFARM	–0.197	–1.36	–0.293	–1.52	–0.129	–0.57
ABLE 7/10	–0.023	–2.13	–0.008	–0.53	–0.036	–2.33
DOCTORS	0.191	4.33	0.184	2.85	0.206	3.35
FEMALE	0.001	0.04				
HH	0.026	6.66	0.019	3.09	0.032	6.15
S 1	8.214	48.80	7.138	33.24	9.242	34.96
Log-likelihood	–8287.8		–4110.83		–4132.6	
No. observations	3738		1884		1854	

Table A2. Participation equation

Variable	All		Females		Males	
	Coefficients	*t*-statistics	Coefficients	*t*-statistics	Coefficients	*t*-statistics
CONST	0.379	0.62	0.820	0.97	1.007	1.19
HEIGHT/100	0.209	0.58	–0.001	–0.26	–0.218	–0.43
WEIGHT/100	–0.020	–0.07	0.001	0.27	0.128	0.34
PAWORK	0.205	2.51	0.150	1.22	0.153	1.24
MAWORK	0.154	3.16	0.170	2.39	0.172	2.42
PAAGEFT/10	–0.284	–1.92	–0.333	–1.58	–0.330	–1.56
MAAGEFT/10	–0.201	–1.11	–0.174	–0.67	–0.176	–0.68
COMP	–0.067	–1.34	–0.152	–2.10	–0.152	–2.09
GRAMMAR	–0.165	–2.26	–0.237	–2.22	–0.234	–2.20
INDEP	–0.761	–6.42	–0.929	–5.40	–0.925	–5.37
SPECIAL	–0.495	–3.17	–0.488	–2.46	–0.491	–2.47
PAFARM	–0.012	–0.08	0.544	2.27	0.543	2.27
ABLE 7/10	0.039	3.54	0.032	2.06	0.032	2.05
LOGINC	–0.096	–1.47	–0.034	–0.35	–0.044	–0.45
UNEMPL	–0.876	–8.36	–0.082	–5.54	–0.834	–5.60
EMPLMWLA/10	–0.639	–1.86	–0.076	–1.52	–0.802	–1.61
OLDSIB	0.005	0.17	–0.009	–0.20	–0.009	–0.19
YNGSIB	0.086	5.03	0.102	4.13	0.101	4.10
FEMALE	0.005	0.11				

On wage rates, we note that we would expect the wage profile of teenagers to be quite flat. Large differences in wage rates between the 16-year-olds studied would be unlikely, because most were yet to sit any formal public examinations, and few would have accumulated much in the way of work experience. We found some weak evidence that physical characteristics affected wage rates, and suggest that employers may use appearance as a proxy for unobservable characteristics likely to affect work performance. Male teenage wage rates were positively influenced by the mother's employment, again perhaps reflecting the better information and contacts available to children with parents in employment. Our most striking finding on wage rates, however, was a negative correlation with ability. We suggest two possible reasons for this. One is that less-able teenagers may invest more in search costs for part-time work, in the hope that it may lead to permanent employment. Another is that the employers of less-able teenagers who perform well may pay them higher rates, in order to encourage them to stay, whilst employers of teenagers of higher ability do not expect them to stay, and therefore pay lower rates.

Appendix: Tables

Endnotes

[1] The banded nature of the hours and earnings data means that the last wage category is necessarily undetermined unless an upper bound is imposed on either the last hours or earnings category. For the purposes of this study, we assume that the maximum weekly hours worked by those still in school is 20. This figure was chosen on the basis of data on hours worked by teenagers in school taken from the Family Expenditure Survey for 1974.

[2] The *t*-statistics are based on standard errors computed as standard deviations in samples of 500 marginal effects, where the vector of parameters is drawn from the estimated asymptotic distribution of the vector of parameter estimates.

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