Economics Division
School of Social Sciences
University of Southampton
Southampton SO17 1BJ UK

Discussion Papers in Economics and Econometrics

Wages and the Education and Employment Choices of Young People: Empirical Analysis for Great Britain

Patricia Rice

No. 0612

This paper is available on our website
http://www.socsci.soton.ac.uk/economics/Research/Discussion_Papers

ISSN 0966-4246

Wages and the education and employment choices of young people: Empirical analysis for Great Britain

by

Patricia Rice
University of Southampton.

(August 2006)

Abstract
This paper examines the responsiveness of the education and employment choices of young people in Great Britain to the level of wages currently available to them in the labour market. Our results show that among young males in particular, the probability of continued participation in full-time education declines significantly as the expected wage increases. The effects for young women are smaller and not statistically significant in general. In addition, we find that the probability of being inactive – not in education, employment or training – increases also with the level of expected wage, particularly in the case of young males of lower academic ability. In the light of these findings, we assess the impact of the recent introduction of a national minimum wage for 16 and 17 year olds on education and employment decisions of young men in Great Britain.

Keywords: Education, employment, wages, young people

JEL Classification: I21, I28

1. Introduction

This paper investigates the responsiveness of the education and employment choices of young people to the current level of wages available in the labour market. This study is motivated by the recent decision of the UK government to introduce a minimum wage for those aged 16 and 17 years from October 2004, following the introduction of a national minimum wage for employees aged 18 years and above in April 1999. This decision has been taken against a background in which participation rates in full-time education among 16 to 18 year-olds in the UK continue to lag significantly behind those in other major developed economies. Following a period of rapid growth in the late 1980s and early 1990s, participation rates have remained stagnant over the last decade, with between 70 and 74 percent of 16 year olds and 58 to 60 percent of 17 year olds in England in full-time education.[1]

The UK is one of a number of countries to introduce, or significantly increase, minimum wages for young workers in recent years. Ireland introduced a national minimum wage in 2000 with a youth rate payable to 16 and 17 year olds at 70% of the adult minimum. While Spain and New Zealand have abolished or substantially reduced the differential between youth and adult minimum wage rates, resulting in large increases in nominal wage rates for young workers.[2]

It is widely recognised that minimum wages for young people not only have potentially negative effects on employment, but may also reduce participation rates in further education and training by reducing the expected return to human capital investment. On the one hand minimum wages increase the opportunity costs of schooling by raising wage rates

[1] Department for Education and Skill (2005), Table 5.

[2] Spain abolished a separate youth rate for 16 and 17 year olds in 1998. The minimum wage for 16 year olds increased in nominal terms by 284% between 1990 and 2000. In the case of New Zealand, the minimum rate for 16 and 17 year olds was increased from 60% to 80% of the adult rate in 2001. Between 2001 and 2003, the minimum wage for 16 year olds increased by 41% in nominal terms.

for young unskilled workers, although this has to be set against a lower probability of receiving a job offer in any period. Moreover, in so far as the introduction of a minimum wage reduces wage differentials between skilled and unskilled workers, the expected wage gain from human capital investment is reduced. Added to these effects on schooling, minimum wages may reduce the incentive for firms to provide general training for young workers by putting a lower bound on the wages that they can be paid. It has been argued that the long term effects of reduced skill acquisition among young people are potentially much more costly than any short-term effects on employment (Neumark and Wascher, 2003)

In making their recommendation, the UK Low Pay Commission acknowledged the potential costs of the policy but argued that there are significant potential benefits to be set against these. The exemption of 16 and 17 year olds from the current legislation is regarded as discriminatory and allows the possibility of exploitation of this group of workers. They point to evidence of very low rates of pay among 16 and 17 year olds, and of employers substituting younger exempt workers for older covered workers (Low Pay Commission, Report 4, p.56). In addition, the proportion of young people in the UK who are inactive - that is not in education, employment or training – has been increasing in recent years, and the Low Pay Commission suggested that the introduction of a minimum wage for this age group would increase the incentives to seek paid employment. (LPC Report 4, p.62). The Low Pay Commission concluded that 'a cautiously set minimum wage' will not discourage participation in full-time education, while continued exemption in the case of those on apprenticeship schemes and/or pre apprenticeship programmes would ensure employers continue to provide training (LPC Report 4, pp.56-58).

However, the available evidence suggests that this conclusion may be optimistic. Influential studies by Neumark and Wascher (1995a,b,c) using US data find that increases in

minimum wages lead to lower rates of school enrolment among 16 to 19 year olds, coupled with higher rates of inactivity (i.e. not in school and not employed) particularly among individuals in the youngest age category (16/17 year olds) and ethnic minorities. They conclude that higher minimum wages result in individuals leaving full-time education in order to 'queue' for better-paid jobs. Employers tend to substitute in favour of these higher quality young workers, resulting in higher rates of unemployment among their lower quality counterparts. A more recent study by the same authors updating the data to 1998 confirms these earlier findings (Neumark and Waschter, 2003). Card (1992) focuses on the effect of the 27% increase in the California state minimum wage in 1988 and finds evidence of decreases in school enrolment in California relative to other comparable states that did not experience an increase in the minimum. More recently, Chaplin, Turner and Paper (2003) analyse US Department of Education data covering the entire population of public school students in the US. They find evidence of lower state-level continuation ratios, particularly between grade 9 and grade 10 (corresponding roughly to ages 16 to 17 years), for states with higher minimum wages.

In addition to the US evidence, there have been a series of studies based on Canadian data, exploiting the fact that minimum wage rates vary by Province as well as by time. Here, the evidence on the effects on school enrolment rates is more mixed. Landon (1997) and Baker (2003) both find that higher minimum wages are associated with lower school enrolment rates among 16 and 17 year olds. However, Campolieti, Fang and Gunderson (2003) report no significant effects on school enrolment rates or rates of employment. Finally, a recent study for New Zealand considers the effects of the 2001 reforms on labour market outcomes for 16-17 year olds and 18-19 year olds (Hyslop and Stillman 2004). Under these reforms, the age of eligibility for adult minimum wage was lowered from 20 to

18 years, and the youth minimum wage rate was increased from 60% to 80% of the adult rate. The study found evidence that the reforms had negative effects on participation in full-time education for both age categories. In addition, there was some evidence that the reforms led to higher rates of unemployment and inactivity among the younger age group, but this finding was less robust.

There is relatively little work on the extent to which the education and employment choices of young people in the UK are influenced by the level of wages available in the labour market. The UK Low Pay Commission commissioned research of both a qualitative and quantitative nature on this question prior to their report, and the recommendation for the introduction the national minimum wage for the 16 and 17 year old age group. In their work, Dickerson and Jones (2004) simulate the impact of introducing a minimum wage on the assumption that its effect is to truncate the distribution of wage offers and thereby increase the expected wage for any 16 year old entering the labour market. A crucial assumption of their model is that individuals differ only with respect to their academic ability and hence their probability of successfully completing the next stage of education. Given this, the predicted effects of the minimum wage depend critically on the shape of the distribution of academic ability. Calibrating the model to 2002 data, they predict that the introduction of a minimum wage of £3.00 (as recommended by the Low Pay Commission, 2004) would reduce participation in full-time education from 70.7% to 66.5% if the distribution of ability is uniform, and to as low as 58.4% if the distribution is very positively skewed. In the case of a bimodal distribution with peaks at each extreme of the ability range, however, the impact of the minimum wage on participation rates appears negligible.

A further piece of commissioned research by Frayne and Goodman (2004) uses a similar approach to that adopted in this paper to investigate the effects of higher wages on the

schooling decision. They report a small, but statistically significant, negative effect of wages on the probability that a young person remains in full-time education. However, their sample is drawn from population of 16 and 17 year olds living in relatively deprived urban areas, and therefore may not be representative of the population as a whole.[3]

In this paper, we examine the impact of expected wages on the decision to continue in full-time education beyond compulsory schooling. We investigate also the effect of the expected wage on the behaviour of those who decide not to continue in full-time education. Is it the case as suggested by the Low Pay Commission that a higher expected wage decreases the probability of inactivity among this group of young people? For these purposes, we estimate a model of the young person's choice of activity on completion of their compulsory schooling using a large, nationally-representative sample of 16 and 17 year olds from England and Wales.

Our results show that decision to remain in full-time education beyond compulsory schooling is influenced by the expected level of wages offered in the local labour market. Among young males in particular, the probability of continued participation in full-time education declines markedly as the expected wage increases. The effects for females tend to be smaller and are not statistically significant in general. At the same time, we find no evidence that a higher expected wage reduces inactivity rates among young people. On the contrary, the probability of inactivity for young males tends to increase with the expected wage level. Further, we find that the magnitude of these effects tends to be greater among lower ability groups.

The paper is organised as follows. Section 2 sets out the model of education and employment choice that provides the framework for the empirical analysis. Section 3

[3] A sample of approx 13,000 persons aged 16 and 17 years drawn from the 10 deprived urban local authorities chosen to pilot an Educational Maintenance Allowance scheme in 1999.

describes the data and the estimation methods used and section 4 reviews the main results. Section 5 concludes with an assessment of the likely impact of the introduction of a national minimum wage on education and employment outcomes for young people.

2. Modelling Education and Employment Outcomes at Age 16 years

In this section of the paper, we outline the structure of the model of education and employment outcomes that provides the framework for the empirical analysis. We start by considering the individual's decision to participate in a further period of full-time education. The model follows that of Heckman and Cameron (1998) in that the education process is assumed to consist of a number of discrete stages, and successful completion of any given stage is a necessary condition for entry to the next stage in the process. On successful completion of each stage of education process, the individual faces a binary choice – to remain in full-time education without any paid employment for another period; or to enter the labour market and seek full-time paid employment.

Consider a young person who has successfully completed schooling *S* and is deciding whether or not to undertake the next stage. The expected return to entering the labour market at end of schooling *S* is given by

$$Y(S;\mathbf{z}) + V^*(S;\mathbf{z}).$$

$Y(S;\mathbf{z})$ denotes expected income in period S+1 for an individual who has successfully completed stage *S* of schooling, conditional on the set of characteristics – individual, family and local area – denoted by **z;** $V^*(S;\mathbf{z})$ denotes expected lifetime earnings from period *S*+2 onwards for an individual who has completed stage S of schooling.

If the individual chooses to remain in full-time education for a further stage, the expected return to entering the labour market at the end of period *S*+1 is

$$\lambda(S+1;\mathbf{z})V^*(S+1;\mathbf{z}) + [1-\lambda(S+1;\mathbf{z})]V^*(S;\mathbf{z}).$$

$V^*(S+1;\mathbf{z})$ denotes expected lifetime earnings from S+2 onwards for an individual who successfully completes up to stage S+1 of schooling, and $\lambda(S+1;\mathbf{z})$ is the probability of successfully completing stage S+1 conditional on $\mathbf{z}$. If the individual does not successful complete stage S+1 then she receives $V^*(S;\mathbf{z})$ as above. It follows that the individual chooses to leave full-time education having completed stage S if

$$Y(S;\mathbf{z}) > \lambda(S+1;\mathbf{z})\left[V^*(S+1;\mathbf{z}) - V^*(S;\mathbf{z})\right] \tag{2.1}$$

Having opted to leave full-time education, the individual searches in the labour market for full-time paid employment. Here we adopt a standard model of sequential job search in which job search while in employment is not feasible.[4] Ex ante, jobs are indistinguishable from each other, as are workers. Ex post, the productivity of any specific job-worker match is a random draw from a probability distribution, with the productivity known to firms and worker as soon as contact is made. There is a distribution of wage offers in the market which is known to the individual. The young person samples jobs sequentially with replacement, and decides whether to accept or reject any wage offer. Under standard assumptions, the optimal search strategy satisfies the reservation property. If the wage offer exceeds the individual's reservation wage, it is accepted and the search process stops; otherwise the young person continues to search. It follows that the expected income of the individual if she enters the labour market, *Y(S,* **x),** depends on probability of receiving a wage offer in excess of her reservation wage, the expected value of an acceptable wage offer and her income if she is without full-time activity.

[4] For further details see Pissarides (1990), Mortenson, D and Pissarides, C. (1999).

The above provides the framework for the empirical analysis that follows. The probability that an individual who leaves full-time education having completed compulsory schooling is without full-time activity after a given interval is determined by the probability of not receiving an acceptable wage offer during this time. For the purposes of empirical analysis, this is represented by a function of the general form

$$\Pr(G(\ln W^E, \tilde{\mathbf{x}}, \varepsilon) > 0) \tag{2.2}$$

LnW^E denotes the expected value of wage offers for the individual, and $\tilde{\mathbf{x}}$ denotes a vector of observable variables that includes individual, family and local area characteristics that influence the young person's reservation wage, and the job offer rate. ε is a random error component capturing the effects of unobservable variables. The probability that the individual chooses to leave full-time education having completed stage *S*, may be described also by a function of the general form

$$\Pr(F(\ln W^E, \mathbf{x}, \upsilon) > 0) \tag{2.3}$$

x is a vector of observable variables relating to the characteristics of the individual, their family and the local area as above, and υ is a second random error term capturing the effects of unobservable variables. Equations (2.2) and (2.3) provide the basis of our statistical model.

3. Data and Estimation

The data for this analysis is taken from the Youth Cohort Studies for England and Wales (YCS). The YCS is a longitudinal study of education, employment and training for a representative sample of 16/17 year olds in England and Wales. The information is collected by postal questionnaire sent to members of the sample in the March/April of the year immediately following their completion of compulsory schooling, with follow-up

questionnaires distributed during the succeeding two or three years. The data used in this study is taken from the first sweep of cohorts 5 to 9, and relate to individuals aged 16/17 years who completed their compulsory schooling in the years 1990, 1991, 1993, 1995 and 1997 respectively.[5] Combining the five studies provides us with a very large sample – 40,992 males and 47,023 females - spanning an eight year period of substantial change in education, training and the youth labour market in Great Britain. The very large sample size allows us to control for a broad range of individual and family characteristics that may influence the education and employment choices of young people.

Young persons in the YCS provide information on their main activity at the time of the survey, and on the basis of this each individual in the sample is assigned to one of three categories according to their stated activities at the time of the survey:

A_i=1 - the ith individual is participating in full-time further education, or is waiting to take up a place in full-time further education;

A_i=2 - the ith individual is in full-time employment in a regular job or as part of a government-supported training scheme, or is waiting to take up full-time employment;

A_i=3 - the ith individual is currently without a full-time activity i.e. he/she is unemployed and seeking work, or inactive or is in part-time education or employment only.

As outlined in Section 2, the empirical model assumes a sequential decision process. First, an individual chooses whether or not to continue in full-time education following compulsory schooling. Conditional on deciding to leave full-time education, the young person then decides between accepting full-time employment, either in a regular job or as part of a

[5] There are two more recent YCS studies for 1999 and 2001 but major changes to the questionnaire following YCS 9 plus a sharp fall in survey response rate (from 65% to 55%) raise doubts about the comparability of this later data with that from the earlier surveys.

government supported training scheme, or remaining without a full-time activity and continuing to search. Using linear approximations of the functions F(.) and G(.) in (2.2) and (2.3), we have

$$Pr(A_i \neq 1) = Pr\left[\alpha_1 \ln W_i^E + \mathbf{x}_i'.\beta_1 + \upsilon_i > 0\right] \tag{3.1}$$

$$Pr(A_i = 3) = Pr\left[\alpha_1 \ln W_i^E + \mathbf{x}_{i_i}'\beta_1 + \upsilon_i > 0 \quad and \quad \alpha_2 \ln W_i^E + \tilde{\mathbf{x}}_i'.\beta_2 + \varepsilon_i > 0\right] \tag{3.2}$$

Assuming that the unobservable error terms υ_i and ε_i are distributed as bivariate normals $(0,0,1,1,\rho)$, the model is estimated as a probit with sample selection.[6]

The sets of regressors in the equations (3.1) and (3.2), $\mathbf{x}_i'$ and $\tilde{\mathbf{x}}_i'$, include measures of the individual's academic ability and the type of school attended, together with indicators of ethnic group and socio-economic background; all derived from information provided in the YCS. These individual-level characteristics are supplemented by local area variables including the local unemployment rate and the industrial composition of local employment. In addition, we consider characteristics of local education provision such as the average expenditure per pupil and the pupil-teacher ratio in local secondary schools and past rates of participation in post-compulsory schooling.[7] Further details of these control variables can be found in the Tables in the Appendix of this paper. For identification purposes, we assume

[6] An alternative approach to estimation would be to model the probability of choosing between the alternative activities identified in the data as a multinomial logit. However, this would impose the restriction of independence of irrelevant alternatives, and this is not an assumption that we would expect to hold in this context. Estimation of a multinomial version of the choice model on the YCS data confirms that this is the case, with the Hausman test rejecting the assumption of independence of irrelevant alternatives in all cases.

[7] The YCS provides information on the local education authority of the individual. LEAs are matched to local authority level data on labour market variables including unemployment and employment available through the National Online Manpower Information Service (NOMIS).

that individual's decision to remain in full-time education is influenced by the type of school attended and by the characteristics of the local education provision, but that these factors play no role in determining the individual's probability of being without a full-time activity having chosen to leave full-time education.

Measuring Academic Ability

Academic ability plays a key role in the decisions relating to education and employment following compulsory schooling. It is usual in studies of this type based on UK data to measure a young person's academic ability in terms of their overall level of attainment in the General Certificate of Secondary Education (GCSE) completed in the final year of compulsory schooling. A drawback of using a measure based on academic outcomes is the potential endogeneity of the variable. An individual's level of attainment in the GCSE depends on both ability and effort, and the latter depends in part on the intended activity following compulsory schooling. Academically able individuals with high levels of motivation have a high probability of continuing in full-time education and of achieving good GCSE results. To mitigate these problems, we take as a measure of academic ability the level of attainment in the mathematics GCSE only. The outcome in mathematics GCSE is expected to be less influenced by the individual's motivation and choice of effort level than their overall attainment level across a range of subjects, some of which are self-selected. The YCS data provides some evidence in support of this contention. The individual's grade in mathematics GCSE is less well predicted by school and family background variables than is the case for their overall level of attainment in the GCSE.[8] Furthermore, we find the grade in

[8] A model of individual's academic performance as a function of gender, ethnic group, parent's education and occupation, type of school attended etc. is estimated using ordered probit. With Mathematics GCSE grade as the dependent variable, the pseudo-squared statistics is 0.08; with overall GCSE performance as the dependent variable the Pseudo R-squared statistics is 0.12.

mathematics GCSE tends to be less highly correlated with observable variables related to individual motivation, for example levels of truancy, than is true for overall GCSE attainment levels.[9]

In the discussion that follows, we focus on the results obtained using the individual's grade in the mathematics GCSE as a measure of academic ability. However, in order to assess the robustness of the findings, we consider also the results obtained using overall level of attainment in the GCSE as the measure of academic ability, and for a reduced-form specification of the estimating equation which does not include any measure of academic outcomes at age 16 years.

Estimating Expected Wages

Estimation of (3.1) and (3.2) requires an estimate of $\ln W^E$, the expected value of wage offers, for each young person in the sample. For this purpose, we assume that individual wages are determined by a simple Mincerian wage function. In this particular context, the population of interest are those who have just completed compulsory schooling and so they have the same quantity of schooling and no relevant labour market experience. However, they differ with respect to levels of academic attainment and demographic characteristics such as gender and ethnicity. The individual wage function is specified as:

$$\ln W_j = \breve{\mathbf{x}}_j' \pi_1 + + u_j \tag{3.3}$$

where W_j denotes the hourly earnings of the jth individual in the sample. The explanatory variables in the wage function, $\breve{\mathbf{x}}_j$, include the individual's academic ability, gender and ethnic group, together with the local unemployment rate, the industrial composition of local

[9] Spearmen rank order correlation coefficient between incidence of truancy in year 11 of schooling and (i) Mathematics GCSE grade is 0.23, (ii) overall GCSE results is 0.29.

employment and a set of local area fixed effects. u_i denotes the unobservable random error term which is assumed to be normally distributed with zero mean in the usual way.

The wage function (3.3) is estimated using data for the YCS sample of 16/17 year olds whose main activity at the time of the survey is full-time paid employment in a regular job. For this group, we have information on their weekly take home pay and their usual hours of work per week.[10] Clearly there are a number of drawbacks to this data. The data relates to take-home pay rather than the variable of interest, namely gross wages. The relationship between net and gross pay may have been affected by changes in the structure of personal taxation over the period, and to capture the effects of these, and to allow for changes in the average price level, a set of time dummies is included in the wage equation (3.3). Hourly net pay is computed as the ratio of weekly take-home pay to usual hours of work, and as such the data is subject to two sources of measurement error which combine multiplicatively. We attempt to reduce the effects of these by excluding the extremes of the sample distribution in both the hours and the pay data, and check the sensitivity of our results to alternative estimation samples.

In estimating the wage equation (3.3), it is necessary to take account of the fact that our sample consists of those that have selected to enter full-time paid employment following schooling. This is done by Heckman selection methods with the specification of the selection equation based on a 'reduced form' version of (2.3) with (3.3) substituted for $\ln W^E$. Thus, selection into full-time paid employment following compulsory schooling depends on a range

[10] In the earlier surveys, data relating to earnings is collected from individuals whose main activity is full-time paid employment in a regular job or in a government-supported training scheme. From YCS8, data on pay has been requested from all those with some paid employment including those whose main activity is full-time education. By using the sample of those in full-time paid employment in a regular job only we ensure comparability across the surveys and avoid the estimation problems associated with multiple selectivity. The data on earnings for those on government-supported training schemes is not used as it does not provide full information on the allowances and other payments that young people may receive as part of the scheme.

of background characteristics – parent's SEG, parent's education, type of school attended household composition etc – that are assumed not to affect the individual's expected wage in the local labour market.

Two further estimation issues are to be noted. First, the achieved YCS sample is known to over-represent certain groups in the population, most notably those in full-time education.[11] To avoid potential bias in the parameter estimates from this source, the sample is weighted so that it matches the population of England and Wales in respect of known characteristics including activity following schooling and also gender, region, school type and GCSE attainment levels.[12] The use of sampling weights in estimation affects both the point estimates of the parameters and the variance-covariance matrix.

Second, young people drawn from the same year group and local area share a wide range of local area characteristics, both observable and unobservable, and hence the assumption of independent errors between observations is unlikely to be satisfied. The estimator of the variance-covariance matrix allows for correlation between error terms within clusters, where a cluster for these purposes is defined by the local authority area and the YCS cohort of the observation. The assumption of independent errors for observations in different clusters is maintained. Given weighting and clustering, the parameters of the wage equation are estimated by pseudo-maximum likelihood methods with standard errors obtained using the Huber-White robust estimator.[13]

[11] The original YCS sample is representative of the population of 16 year-olds but the response rate averages approximately 70%. For further details of YCS response rates see Courtenay and McAleese, 1993a, 1993b.

[12] For details of the construction of the sampling weights see Courtenay and McAleese, 1993a, 1993b.
[13] Computed using the survey estimation procedures of Stata 8 (StataCorp, 2002).

Table 1: Predicted market wage: sample statistics

		Males			Females		
		Sample size	**Mean**	**St. dev.**	**Sample size**	**Mean**	**St. dev.**
(1)	**Actual (ln) hourly earnings of those in full-time regular employment**	3590	0.7196	0.4058	2813	0.7578	0.4046
	Predicted (ln) hourly earnings:						
(2)	**OLS estimates: full sample**	40911	0.7863	0.1915	46949	0.8119	0.1918
(3)	**ML estimates: full sample**	40911	0.7342	0.1856	46949	0.7545	0.1863
(4)	**those in full-time education**	28405	0.7722	0.1853	35406	0.7793	0.1867
(5)	**those in full-time regular employment**	4341	0.6785	0.1636	3385	0.7100	0.1685
(6)	**those in a government supported training scheme**	5472	0.6488	0.1663	4518	0.6582	0.1631
(7)	**those without full-time activity i.e. not in education, employment or training**	2693	0.6883	0.1683	3640	0.7103	0.1714

The estimated wage equation (3.3) is used to predict expected hourly earnings for each individual in the full YCS sample. The first row of Table 1 reports the sample mean and standard deviation of net hourly pay for the estimation sample. This is followed by summary statistics for predicted earnings for the whole YCS sample derived from alternative estimates of the wage equation (3.3). As expected, OLS estimates of expected earnings (2) tend to be higher than the corresponding ML estimates (3). The OLS estimator fails to take into account the fact that those individuals who select to enter full-time employment have on average a positive unobservable term in the wage equation and incorrectly attributes this positive term to the observable component of the wage equation. Rows 4 to 7 of Table 1 report summary statistics for expected earnings conditional on the current activity of the individual.

Consistent with their higher average ability, the mean of expected earnings is greatest for those in full-time education. Those on government supported training programmes tend to have lower expected earnings than those in regular employment. Interestingly, there does not appear to be a significant difference in this respect between those in regular employment and those without full-time activity.

4. Expected Wages and Participation in Education, Employment or Training.

The probit model of education and employment outcomes for a young person described in section 3 is estimated with the ML predictions for expected earnings used as the measure of the individual's expected wage offer, $\ln W^E$. The point estimates of the parameters of the model are obtained by pseudo-maximum likelihood methods with sampling weights to allow for the over-representation in the sample of certain groups. The Huber-White robust estimator of the variance-covariance matrix allows for the correlation of error terms within clusters while the assumption of independent errors for observations in different clusters is maintained.[14]

Our main interest in this paper is with the effects of expected wages on education and employment outcomes. The full set of parameter estimates for the model is reported in the Appendix to the paper. As far as the other variables in the model are concerned, the results are consistent with the findings of earlier work on participation in education and training in the UK.[15] As expected, academic ability – measured here by the individual's level of attainment in GCSE Mathematics – plays a major role in determining the probability of continuing in full-time further education, and, to a lesser extent, the probability of being inactive, having opted not to continue in education. Other aspects of the individual's

[14] Where a cluster is defined by the local authority area and the YCS cohort of the observation as before.
[15] For example Cheng (1995), Rice (1999).

educational background, as indicated by the type of school attended, exert a significant independent influence, as do factors related to the individual's ethnicity and socio-economic background.

Table 2 shows the estimated effects of expected wages on the probability of a young person not continuing in full-time education at age 16/17 and on the probability of a young person being inactive – that is not engaged in full-time education, employment or training. Given that the expected wage variable is itself generated by regression methods, the standard errors of the parameter estimates are obtained by bootstrap methods.[16] Conventional asymptotic standard errors are reported also for purposes of comparison. In addition, Table 2 gives the implied marginal effect on the predicted probability of the outcome for a representative individual.

All other things being equal, higher expected wages significantly increase the probability that a young male chooses not to continue in full-time education beyond compulsory schooling. For the representative individual, a 1% increase in the expected wage increases the probability of not continuing in full-time education by 0.17, implying an elasticity of 0.44. For females, the estimated effect is considerably smaller and not statistically significant. At the same time, we find no evidence that higher expected wages reduce the probability that an individual is inactive at age 16/17 years. On the contrary, the probability that a young male is without a full-time activity is found to increase with the level of expected earnings. The implied elasticity is approximately 1 but the estimated effect is statistically significant only at the 10 percent level. Again, the effect for young females is smaller and not statistically significant.

[16] The standard errors are computed by using bootstrap procedures in Stata 8 with 1000 replications.

Table 2: Marginal Effects of Expected Earnings on Education and Employment Outcomes for 16/17 years.[a]

	On probability of not continuing in full-time further education		On probability of being without full-time activity	
	Males	***Females***	***Males***	***Females***
Mathematics GCSE grade as measure of academic ability:				
Parameter estimate	0.4485**	0.1781	0.5525*	0.3018
Asymptotic standard error	0.1639	0.1524	0.3104	0.2482
Bootstrap standard error	0.1633	0.1567	0.2856	0.2593
95% confidence interval[b]				
LB	0.1219	-0.1471	-0.0411	-0.1754
UB	0.7686	0.4603	1.0723	0.8582
Predicted (marginal) probability for representative individual	0.4019	0.2590	0.0656	0.1045
Marginal effect on predicted probability	0.1735	0.0576	0.0705	0.0547

[a] The predicted probability of the outcome and marginal effects computed for individual with the following characteristics: ethnic group=white; GCSE Mathematics =grade D; school type=comprehensive ages 11-16; father's occupation=craft and related; mother's occupation=clerical and secretarial; parental employment status=both parents are employees currently in full-time employment; household composition=both parents in household, one sibling in household; housing tenure=owner-occupier; region=south east of England; year=completed compulsory schooling in academic year 1996/97. Local area characteristics = average value in 1997 for all LEAs in sample.
[b] computed by the percentile method (bias-corrected).
* indicates statistical significance at the 10% level; ** at the 5% level

These results are robust to using overall level of attainment in the GCSE as an alternative to performance in mathematics GCSE as a measure of academic ability throughout, and to excluding outcome-based measures of academic ability from the model altogether.[17] The estimated marginal effects for these alternative specifications are of similar orders of magnitude but are somewhat less well-determined than for the preferred specification reported in Table 2. In addition, we investigated the robustness of the findings to alternative estimates of expected wages resulting from varying the sample used for estimation of the wage equation (3.3).[18] Here too, the estimates are of similar orders of magnitude to those reported in Table 2.

In their earlier work for the US, Neumark and Wascher suggested that higher minimum wages reduce participation in further education among higher ability groups while increasing levels of unemployment for lower ability individuals. In order to investigate whether a similar pattern of responses is evident in the UK, we re-estimate the model splitting the sample into high and low ability groups according to the individual's grade in mathematics GCSE. A difficulty with this exercise is that the number of individuals in the higher ability group that are unemployed – that is not in full-time education, employment or training – is very small. As a result, it is not possible to obtain reliable estimates of the effects of expected wages on the probability of being unemployed for this group.

The effects of expected wages on the probability of continuing in full-time education at age 16 years for young males are broadly similar for the two ability groups. The marginal effect is larger in absolute terms for the lower ability group but the implied elasticities are approximately the same – 0.52 for the higher ability group and 0.47 for the lower ability

[17] In each case, the measure of expected wages used in the bivariate probit model is computed from the corresponding specification of the wage equation.
[18] Different estimation samples are obtained by varying the criteria for excluding extreme values from the net weekly pay and hours of work data.

group. However, only in the latter case is the estimate statistically significant at the 5 percent level. Among young women, the probability of continuing in full-time education appears to be more responsive to expected wages for the higher ability group, but in neither case are the estimates statistically significant.

Again, we find no evidence to support the contention that higher expected wages reduce the probability of a young person being inactive i.e. not in full-time education, training or employment. For those of lower academic ability, both males and females, the probability of being inactive is positively related to the level of expected wages, with an implied elasticity of approximately 1. In both cases, the parameter estimates are statistically significant at the 10 percent level. These results are consistent with the Neumark and Waschter finding for the US that higher minimum wages lead to higher rates of inactivity among young people of lower ability.

Table 3: Marginal Effects of Expected Earnings on Education and Employment Outcomes for 16/17 years.[a] – Differences by Ability.

	On probability of not continuing in full-time further education		On probability of being without full-time activity	
	Males	***Females***	***Males***	***Females***
Higher ability – grade A, B or C in Mathematics GCSE				
Parameter estimate	0.3711	0.4029	na	na
Asymptotic standard error	0.2396	0.2760		
Bootstrap standard error	0.2766	0.2997		
95% confidence interval[b]				
LB	-0.1991	-0.1582		
UB	0.9201	1.0423		
Predicted (marginal) probability for representative individual	0.1502	0.0610		
Marginal effect on predicted probability	0.0866	0.0486		
Lower ability – grade D or lower in Mathematics GCSE				
Parameter estimate	0.5322**	0.1239	0.5262*	0.4973*
Asymptotic standard error	0.2012	0.1713	0.3430	0.2657
Bootstrap standard error	0.2059	0.1809	0.3246	0.2899
95% confidence interval[b]				
LB	0.1126	-0.2257	-0.0472	-0.0260
UB	0.9172	0.4617	1.1522	1.1081
Predicted (marginal) probability for representative individual	0.4484	0.3097	0.1103	0.1177
Marginal effect on predicted probability	0.2105	0.0437	0.0992	0.0981

[a] The predicted probability and marginal effects computed for individual with the following characteristics: ethnic group=white; school type=comprehensive ages 11-16; father's occupation=craft and related; mother's occupation=clerical and secretarial; parental employment status=both parents are employees currently in full-time employment; household composition=both parents in household, one sibling in household; housing tenure=owner-occupier; region=south east of England; year=completed compulsory schooling in academic year 1996/97. Local area characteristics = average value in 1997 for all LEAs in sample.

[b] Computed by the percentile method (bias-corrected).

* indicates statistical significance at the 10% level; ** at the 5% level

5. The Impact of a National Minimum Wage for 16/17 years olds.

The results reported above establish that for young males at least, education and employment choices at age 16/17 are responsive to changes in the expected value of wage offers in the market. In the light of the results, what is the likely impact of the introduction of a national minimum wage on education and employment outcomes for this group of young people? Clearly this depends critically not only on the level set for the national minimum, but also on the impact of a national minimum on the overall distribution of wage offers facing young people. For the latter, we consider two possible scenarios. First, the distribution of wage offers is truncated at the value of the NMW and all wage offers below this value are increased to the NMW, creating a mass point at this value and leaving the distribution of wage offers above the NMW essentially unaffected. The second possibility is that the introduction of the NMW has spillover effects on wage offers above the national minimum. The distribution of wage offers is truncated at the value of the NMW as before, but wage offers are redistributed at and above the NMW with no mass point at this value. In both scenarios, the introduction of the NMW increases the expected value of the wage offer for the individual, but by more in the latter case.

We simulate the effect of a national minimum wage on employment and education outcomes for young males in both these cases based on the parameter estimates reported in Table 3. Two possible levels for the national minimum are considered; one corresponding to the lowest decile of the observed distribution of hourly earnings for young people in each year of the sample, and the other corresponding to the lowest quartile. The NMW for 16/17 year olds was introduced in October 2004 at the rate of £3.00 per hour which corresponds approximately to the lowest decile of gross hourly earnings for 16 year olds in April 2004.[19]

[19] Low Pay Commission (2005), Table 5.4, p. 144.

From the average predicted probabilities reported in Table 5, it would appear that the impact of a NMW for 16/17 year olds on educational and employment outcomes is likely to be small. A NMW set at a level corresponding to the lowest decile of the observed distribution of actual earnings would reduce the expected participation rate in full-time further education among young males by no more than 1 percentage point. A more generous NMW set at the equivalent of the lower quartile would result in a decline of between 1 and 2.4 percentage points depending on the extent of the spillover effects on the overall distribution of wage offers. The impact of a NMW on the proportion of the cohort without any full-time activity is of a similar order of magnitude, namely between 0.3 and 2.2 percentage points depending on the level of the NMW and the extent of spillover effects on the distribution of wage offers.

Table 5: Introduction of a National Minimum Wage: Effects on Young Males

	Average predicted probability of not continuing in full-time further education[a]		*Average predicted probability of being without a full-time activity*[a]	
	Truncated distribution with mass point at the NMW	***Truncated distribution smoothed above NMW***	***Truncated distribution with mass point at the NMW***	***Truncated distribution smoothed above NMW***
No NMW	0.3647	0.3647	0.1470	0.1470
NMW equivalent to lowest decile	0.3675	0.3747	0.1495	0.1562
NMW equivalent to lower quartile	0.3743	0.3880	0.1559	0.1694
Higher ability – grade A, B, C grade in Mathematics GCSE				
No NMW	0.1234	0.1234		
NMW equivalent to lowest decile	0.1244	0.1276	*na*	*na*
NMW equivalent to lower quartile	0.1274	0.1341	*na*	*na*
Low ability – grade D or lower in Mathematics GCSE				
No NMW	0.5397	0.5397	0.2186	0.2186
NMW equivalent to lowest decile	0.5442	0.5555	0.2222	0.2314
NMW equivalent to lower quartile	0.5549	0.5755	0.2310	0.2487

[a] Mean of the sample distribution of predicted (marginal) probabilities

However, as we have already seen, the responsiveness of the behaviour to changes in the expected wage offer varies across ability groups. It is among young males in the lower ability range that the impact of the introduction of NMW is likely to be greatest. However, even among this group, the expected changes are modest. With a NMW set at the equivalent of the lowest decile of observed earnings, their expected participation rate in full-time

education declines by at most 1.6 percentage points, while unemployment rates among the group increase by around 1.3 percentage points. With a NMW set at the equivalent of the lowest quartile these figures increase to 3.6 and 3 percentage points respectively.

On balance our results would seem to support the view of the UK's Low Pay Commission that 'a cautiously set minimum wage' will not have a substantial negative effect on participation in full-time education. That said, it is evident that the decision to continue in full-time education among young males is responsive to the level of wages offered in the labour market, and substantial increases in the level of the NMW could lead to a significant reduction in education participation, particularly among lower ability groups. As for the assertion that the introduction of a NMW may encourage those young persons without full-time activity to seek employment, we find no evidence to support this view. On the contrary, our results are consistent with the findings of earlier US studies that higher wages tend to be associated with higher rates of inactivity among young males.

APPENDIX
PROBABILITY OF NOT BEING IN FULL-TIME FURTHER EDUCATION AT AGE 16/17 YEARS (ENGLAND AND WALES)

	Males	Females
Expected hourly wage (in regular full-time employment)	0.4485 (2.74)**	0.1780 (1.17)
Academic ability: Maths GCSE grade D		
Mathematics GCSE grade: A	-1.4357 (-23.34)**	-1.2895 (-18.75)**
Mathematics GCSE grade: B	-0.9117 (-22.73)**	-0.8771 (-24.75)**
Mathematics GCSE grade: C	-0.5104 (-19.10)**	-0.4321 (-16.30)**
Mathematics GCSE grade: E	0.1872 (6.46)**	0.1417 (5.40)**
Mathematics GCSE grade: F	0.3548 (9.64)**	0.2985 (9.69)**
Mathematics GCSE grade: G	0.5515 (10.36)**	0.4438 (10.89)**
Mathematics GCSE grade: uncl	0.5851 (8.70)**	0.4698 (9.06)**
Mathematics GCSE: not taken	0.9486 (26.25)**	0.8564 (26.14)**
Type of school attended: comprehensive for ages 11-16 years		
Comprehensive for 11-18 years	-0.1240 (-6.22)**	-0.1543 (-8.13)**
Grammar (selective)	-0.2501 (-3.36)**	-0.2097 (-3.37)**
Secondary modern/other	0.0376 (0.90)	-0.0477 (-0.96)
Independent/Grammar	-0.8346 (-11.71)**	-0.6486 (-9.45)**
Ethnic group: white		
Afro-caribbean	-0.7027 (-7.39)**	-0.6528 (-9.02)**
Indian	-1.1306 (-12.65)**	-0.6968 (-9.32)**
Pakistani/ Bangladeshi	-1.0365 (-16.12)**	-0.5566 (-9.92)**
Chinese / other Asian	-1.1020 (-8.72)**	-0.5773 (-5.23)**
Other	-0.5443 (-4.76)**	-0.3784 (-3.78)**
Parent's Education		
Father has a degree	-0.0490 (-1.41)	0.0152 (0.46)
Mother has a degree	0.0037 (0.10)	0.0465 (1.22)
Father's SEG: craft and related		
Managers & administrators	-0.2941 (-10.41)**	-0.1637 (-5.58)**
Professional	-0.5171 (-11.12)**	-0.4092 (-8.82)**
Associate professional & technical	-0.3767 (-8.68)**	-0.2015 (-4.66)**
Clerical & secretarial	-0.2132 (-4.81)**	-0.1318 (-2.83)**
Personal and protective service	-0.1906 (-4.66)**	-0.1424 (-3.44)**
Sales and related	-0.2072 (-4.07)**	-0.0989 (-1.98)**
Plant and machine operatives	0.0405 (1.43)	0.0252 (0.87)
Other occupations	0.0019 (0.05)	0.1177 (2.93)**
Mother's SEG: Clerical & secretarial		
Managers & administrators	0.0349 (0.85)	0.0785 (1.99)**
Professional	-0.3561 (-6.95)**	-0.2975 (-5.70)**
Associate professional & technical	-0.1478 (-3.85)**	-0.1142 (-2.99)**
Craft and related	0.1272 (1.99)**	0.2574 (4.30)**
Personal and protective service	0.0995 (2.97)**	0.0869 (2.98)**
Sales and related	0.0990 (2.66)**	0.2075 (5.56)**
Plant and machine operatives	0.2445 (4.08)**	0.2335 (4.99)**
Other occupations	0.2365 (5.91)**	0.2358 (6.48)**

	Males	Females
Father self employed	0.0483 (2.00)**	0.0023 (0.11)
Mother self employed	-0.0080 (-0.23)	0.0224 (0.67)
Father currently not working full-time	-0.0205 (-0.64)	0.0246 (0.93)
Mother currently not working full-time	-0.0739 (-3.56)**	-0.0753 (-3.65)**
Household composition: both parents		
Father only in household	0.1329 (2.45)**	0.09120 (1.72)*
Mother only in household	0.0042 (0.12)	-0.0784 (-2.53)**
Neither parent in household	0.5568 (7.36)**	0.6593 (13.15)**
Number of siblings in household	0.0261 (3.23)**	-0.0089 (-1.16)
Housing tenure: owner occupier		
Rented –council	0.2433 (8.98)**	0.3242 (12.54)**
Rented – housing association	0.0553 (0.73)	0.2255 (4.06)**
Rented – private	0.1336 (2.18)**	0.2702 (5.96)**
Other	0.2892 (4.14)**	0.2332 (3.99)**
Local area variables:		
(Ln) unemployment rate	-0.1018 (-2.48)**	-0.0291 (-0.87)
(Ln) change in unemployment rate	-0.1168 (-1.25)	-0.2167 (-2.74)**
(Ln) % employment in production sector	0.1365 (2.26)**	0.1588 (2.71)**
(Ln) % employment in financial and banking services	-0.0928 (-2.01)**	0.0779 (1.72)*
(Ln) % of 16 year olds in LEA continued in full-time FE in previous year.	-0.4589 (-3.86)**	-0.5364 (-5.11)**
(Ln) Pupil-teacher ratio in secondary schools (five year average)	0.1006 (0.44)	0.5726 (2.57)**
Year: YCS 9 (1997)		
YCS 5 (1990)	0.3390 (3.57)**	0.2783 (3.34)**
YCS 6 (1991)	0.1826 (2.29)**	0.1099 (1.47)
YCS 7 (1993)	0.0214 (0.36)	0.0355 (0.65)
YCS 8 (1995)	0.0045 (0.11)	-0.0037 (-0.10)
Region: South East		
North	0.3290 (6.08)**	0.1471 (2.86)**
North West	0.2497 (5.51)**	0.1360 (3.10)**
Yorkshire and Humberside	0.2387 (5.97)**	0.1515 (3.42)**
East Midlands	0.0889 (2.11)**	0.0995 (2.07)**
West Midlands	0.1498 (3.51)**	0.0960 (2.11)**
East Anglia	0.0894 (1.91)*	0.0410 (0.92)
Greater London	-0.0265 (-0.52)	-0.0539 (-1.15)
South West	0.1580 (3.66)**	0.0391 (1.04)
Wales	0.0579 (1.20)	-0.0058 (-0.11)
Constant term	0.9111 (1.05)	-0.8548 (-1.00)
(Adjusted) Wald statistic F(79,486)	100.20	91.36

* indicates statistical significance at the 10% level; ** at the 5% level

PROBABILITY OF BEING INACTIVE (I.E. NOT UNDERTAKING FULL-TIME EDUCATION, EMPLOYMENT OR TRAINING) AT AGE 16/17 YEARS

	Males	Females
Expected hourly wage	0.5524 (1.78)*	0.3018 (1.22)
Academic ability: Maths GCSE grade D		
Mathematics GCSE grade: A	-0.1776 (-0.88)	-0.1569 (-0.66)
Mathematics GCSE grade: B	-0.1353 (-1.18)	-0.2473 (-1.91)*
Mathematics GCSE grade: C	-0.0972 (-1.38)	-0.1350 (-2.04)**
Mathematics GCSE grade: E	0.1100 (1.99)**	0.1322 (2.65)**
Mathematics GCSE grade: F	0.1840 (2.83)**	0.2686 (4.60)**
Mathematics GCSE grade: G	0.2823 (3.52)**	0.3699 (5.32)**
Mathematics GCSE grade: uncl	0.4624 (4.57)**	0.4214 (4.80)**
Mathematics GCSE: not taken	0.5484 (7.27)**	0.6259 (9.36)**
Did not undertake work experience at school	0.2445 (5.71)**	0.2133 (5.03)**
Ethnic group: white		
Afro-caribbean	-0.1707 (-1.14)	0.0453 (0.38)
Indian	0.1281 (0.66)	0.1710 (1.10)
Pakistani/Bangladeshi	0.1880 (1.23)	0.1965 (1.57)
Chinese /Other Asian	0.0753 (0.29)	0.2101 (0.84)
Other	-0.1007 (-0.49)	0.2598 (1.54)
Father's SEG: craft and related		
Managers & administrators	-0.0280 (-0.44)	-0.1033 (-1.78)*
Professional	0.0521 (0.48)	-0.2146 (-2.14)**
Associate professional & technical	0.1112 (1.21)	-0.0873 (-1.00)
Clerical & secretarial	-0.1122 (-1.22)	-0.1217 (-1.55)
Personal and protective service	0.0399 (0.54)	-0.1415 (-1.83)*
Sales and related	0.0878 (0.98)	-0.0848 (-0.91)
Plant and machine operatives	0.1204 (2.70)**	-0.0466 (-0.96)
Other occupations	0.1000 (1.61)	-0.0553 (-0.95)
Mother's SEG: Clerical & secretarial		
Managers & administrators	0.2651 (3.32)**	0.0376 (0.43)
Professional	0.2621 (2.28)**	0.0381 (0.32)
Associate professional & technical	0.1754 (2.26)**	0.1009 (1.22)
Craft and related	0.0657 (0.60)	-0.0215 (-0.23)
Personal and protective service	0.1164 (1.97)**	0.0876 (1.42)
Sales and related	0.2509 (3.36)**	0.1665 (2.56)**
Plant and machine operatives	0.2201 (2.52)**	0.0369 (0.43)
Other occupations	0.1681 (2.48)**	0.1457 (2.11)**
Parent's Education		
Father has a degree	0.0029 (0.04)	0.0916 (1.51)
Mother has a degree	0.1439 (2.06)**	0.0637 (0.98)
Father self employed	0.0674 (1.57)	-0.0039 (-0.10)
Mother self employed	-0.0735 (-1.21)	0.0187 (0.32)
Father currently not working full-time	0.1430 (3.16)**	0.0844 (2.12)**
Mother currently not working full-time	-0.0186 (-0.49)	0.0149 (0.44)

	Males	Females
Household composition: both parents		
Father only in household	0.3059 (3.98)**	0.2831 (3.50)**
Mother only in household	0.2654 (4.90)**	0.1225 (2.37)**
Neither parent in household	0.3253 (3.67)**	0.7211 (10.79)**
Number of siblings in household	0.0210 (1.58)	-0.0039 (-0.32)
Housing tenure: owner occupier		
Rented –council	0.2742 (6.64)**	0.3303 (8.35)**
Rented – housing association	0.2918 (2.97)**	0.2831 (3.27)**
Rented – private	0.1774 (1.97)**	0.2892 (3.99)**
Other	0.0828 (0.66)	0.1175 (1.43)
Local labour market conditions:		
(Ln) unemployment rate	0.0780 (1.20)	0.0991 (1.72)*
(Ln) change in unemployment rate	0.3022 (2.13)**	0.1373 (1.08)
(Ln) % employment in production sector	0.0277 (0.25)	-0.1087 (-1.04)
(Ln) % employment in financial and banking services	0.1877 (2.12)**	0.0916 (1.23)
Year: YCS 9 (1997)		
YCS 5 (1990)	-0.3522 (-2.27)**	-0.3530 (-2.59)**
YCS 6 (1991)	-0.0169 (-0.13)	-0.1801 (-1.54)
YCS 7 (1993)	-0.0095 (-0.09)	-0.0629 (-0.70)
YCS 8 (1995)	0.1801 (2.51)**	0.0574 (0.95)
Region: South East		
North	-0.1844 (-1.84)*	-0.0869 (-1.10)
North West	-0.0386 (-0.47)	0.0348 (0.54)
Yorkshire and Humberside	-0.1148 (-1.40)	-0.0410 (-0.59)
East Midlands	-0.1328 (-1.46)	0.0088 (0.12)
West Midlands	-0.1361 (-1.46)	-0.0664 (-0.94)
East Anglia	0.0106 (0.12)	0.0786 (1.07)
Greater London	-0.0873 (-1.03)	-0.1274 (-1.79)*
South West	0.0047 (0.07)	-0.1063 (-1.94)*
Wales	-0.0468 (-0.55)	0.0439 (0.67)
Constant term	-2.7553 (-5.28)**	-1.5920 (-3.14)**
(Adjusted) Wald statistic F(74,491)	12.75	16.02
Sample size	40456	46471
Censored		
Uncensored		
rho	0.2876	0.4143
atrho	0.2959 (2.18)**	0.4408 (2.98)**

* indicates statistical significance at the 5% level; ** at the 1% level

Bibliography

Baker, M. (2003). "Minimum wages and human capital investments of young workers: work related training and school enrolment." *Mimeo,* University of Toronto.

Cameron, S and J. Heckman (1998). "Life cycle schooling and dynamic selection bias: Models and evidence for five cohorts of American males." *Journal of Political Economy,* 106 (2), 262-333.

Campolieti, M., Fang, T., and Morley Gunderson (2002). "Minimum wage impacts on youth employment transistions." *Mimeo,* University of Toronto.

Card, D. (1992). "Do minimum wages reduce employment? A case study of California 1987-1989." *Industrial and Labour Relations Review,* 46, 38-54.

Chaplin, Turner and Paper (2003). "Minimum wages and school enrolment of teenagers: a look at the 1990s." *Economics of Education Review,* 22, 11-21

Cheng, Y. (1995). "Staying-on in full-time education after 16: Do schools make a difference?" *ED Research Series, Youth Cohort Report 37* (October).

Department for Education and Skills (2005). "Participation in education, training and employment by 16-18 year olds in England." *Statistical First Release,* SFR27/2005 (http://www.dfes.gov.uk/rsgateway/DB/SFR/s000587/SFR27-2005.pdf).

Fishe, R., Trost, R., and Lurie, P. (1981). "Labor force earnings and college choice of young women: an examination of selectivity bias and comparative advantage." *Economics of Education Review,* 1.2, 169-191.

Frayne, C. and Goodman, A (2004). "The impact of introducing a national minimum wage for 16 and 17 year olds on employment and education outcomes." *Report for the Low Pay Commission,* Institute for Fiscal Studies.

Hyslop, D., and S. Stillman (2004). "Youth minimum wage reform and the labour market." *New Zealand Treasury Working paper 04/03.*

Landon , S., (1997). "High school enrolment, minimum wages and education spending." *Canadian Public Policy, 23, 141-163*

Low Pay Commission (2004). *Protecting Young Workers: Low Pay Commission Report 2004.*

Neumark, D., and Wascher, W. (1995a). "Minimum wage effects on employment and school enrolment." *Journal of Business and Economic Statistics*, 13(2), 199-208.

Neumark, D., and Wascher, W. (1995b). "The effects of minimum wages on teenage employment and enrolment: evidence from matched CPS surveys." *Research in Labor Economics,* 15, 25-63.

Neumark, D., and Wascher, W. (1995c). "Minimum wage effects on school and work transitions of teenagers." *American Economic Review,* 85(2), 244-249.

Neumark and Wascher (2003). "Minimum wages and skill acquisition: another look at schooling effects." *Economics of Education Review,* 22, 1-10.

Rice, P. (1999). "The impact of local labour markets on investment in further education: Evidence from the England and Wales youth cohort studies." *Journal of Population Economics,* 12, 287-312.

StataCorp (2003), *Stata Statistical Software: Release 8*. College Station, TX: StataCorp LP.