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ABSTRACT

The Relative Importance of Local Labour Market Conditions and Pupil Attainment on Post-Compulsory Schooling Decisions

This paper assesses the relative importance of local labour market conditions and pupil educational attainment as primary determinants of the post-compulsory schooling decision. Using a nested logit model we formally incorporate the structured and sequential decision process pupils engage with. Our findings show that, on average, the key drivers of the schooling decision are pupil educational attainment and parental aspirations rather than local labour market conditions. However, there is some evidence that higher local unemployment rates encourage males to invest in education, and that interactions with educational attainment suggest local labour market conditions impact heterogeneously across the pupil population.

JEL Classification: I21, J18, J24

Keywords: post-compulsory education, local labour markets, parental aspirations, educational attainment, nested logit

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INTRODUCTION

Why do some pupils stay on in post-compulsory education and others not? Ability and interest in academic achievement are clearly likely to be important drivers in the decision to leave full time education or not. However, the choices facing pupils after the end of compulsory education (age 16 in England) are many and the factors determining these pupils' post 16 destinations are likely to be both complex and inter-related, an issue we address directly in this paper. Consideration of the determinants of post-compulsory education has particular current policy relevance in the UK as youth unemployment rates hit a 15 year historical high with over 1 million or 21.9% of economically active 16-24 year olds (in July-September 2011) looking for work. In a period where UK youth unemployment has passed the one million mark, and economic growth continues to stagnate amid European economic insecurity, the question of what determines post compulsory education staying on rates is key for public policy. As is evident from Figure 1, there is also a long term upward trend in the proportion of young people remaining in full time education at age 16-18 that needs to be taken into account. Although UK focussed, the relevance of this paper to inform similar debates on youth unemployment and educational investment decisions in the US and many other European countries is clear. Understanding the determinants of post compulsory schooling choices, and in particular the role that labour market conditions play, is crucial for the design of effective policy measures which seek to alter education leaving decisions in the midst of a labour market contraction.

A number of policies pursued by the British government are directly relevant to the findings in this paper and we seek to inform the policy debate in this area. Firstly, a youth minimum wage rate was introduced in October 2004. Potentially a higher minimum wage might both

draw young people into the labour market, attracted by the higher wage, and simultaneously price young (generally less skilled) workers out of some jobs. Recent work has attempted to measure the impact of the introduction of the national minimum wage on the proportion of young people remaining in post compulsory education (Rice (2010)) and the impact of extending the minimum wage to 16-17 year olds on their choices (De Coulon et al (2009); Crawford et al (2011)[1]). This paper examines the relationship between labour market conditions, namely youth wages and unemployment, and the decisions made by young people, and so can inform us as to whether any increase in the minimum wage is likely to impact on the choices made. The government also introduced a policy called the educational maintenance allowance (EMA) in September 2004, which paid young people from disadvantaged backgrounds a modest amount each week if they remained in full time education. This allowance has been found to have reduced education drop-out rates at age 16 (Dearden et al (2009)). The analysis in this paper covers a period during which disadvantaged young people were in receipt of this allowance and this may have perhaps made them less sensitive to labour market conditions. Since the EMA was abolished this year (2011), we must be mindful that the behaviour we observe in our data may have been influenced by EMA and that going forward, young people may be more sensitive to labour market conditions, a point we return to in our discussion.

The contribution of this paper to the research question is twofold; firstly a nested logit model is proposed that formally incorporates the structured and sequential decision making process that pupils engage with in relation to the post-compulsory schooling decision. Secondly, the research assesses the relative importance of local labour market conditions and pupil educational attainment as the primary determinants of the post-compulsory schooling decision. The analysis is based on using rich socioeconomic data from the Longitudinal Study

of Young People in England (LSYPE), coupled with individual-level pupil attainment and school-based data available through national administrative databases (National Pupil Database, the Pupil Level Annual School Census and the LEA and School Information Service), and local labour market data (Annual Survey of Hours and Earnings and Annual Population Survey). We argue that such high quality data and an appropriate model specification allows identification of the determinants of the post-compulsory decision in a more theoretically consistent manner than previous analyses. Further our analysis allows for better policy prediction of measures to alter the observed distribution of pupil school-leaving.

The paper is organised as follows: Section 2 describes the theoretical framework and related literature. Section 3 presents the model specification and estimation strategy. Section 4 presents an overview of the main data sets used for the analysis. Section 5 presents the findings from the estimated nested logit model. Section 6 presents a summary and conclusion to the paper.

I. THEORETICAL FRAMEWORK AND THE RELATED LITERATURE

The analysis of individuals' decisions on participation in post compulsory schooling can be framed in the theoretical framework of the human capital investment model. According to this model - first proposed by Becker (1964) and Ben-Porath (1967) and successively extended (see for example Card and Lemieux (2001)) - schooling investment is undertaken if the expected benefits from education exceed the costs. The expected returns mainly consist of higher wages and/or lower risk of unemployment. The costs of staying-on in post compulsory schooling include direct costs (schooling related expenses, such as college fees, costs of books and material, etc.), non monetary costs (such as net effort, dislike for studying[2], etc.)

and, crucially, the indirect cost of foregone earnings. In this context, labour market conditions can affect both the costs and the benefits related to the schooling decision.

Theoretically, the unemployment rate has an ambiguous effect on individuals' demand for education. On the one hand, current high youth unemployment rates may discourage early school leaving by reducing the expected gain from job search and by reducing the opportunity cost of schooling. This is the so called discouraged worker effect, whereby young people withdraw from the labour market in the face of high unemployment. On the other hand, high adult unemployment may increase the probability of expected future unemployment, which in turn reduces the return to education and therefore the probability of staying on at school after the compulsory leaving age (see Micklewright et al 1990 and Petrongolo and San Segundo, 2002). Of course young people may not have good labour market information and in practice therefore youth may use the headline adult unemployment rate to guide their decisions and again the likely effect is ambiguous depending on whether the discouraged worker effect dominates or not.

Empirical evidence on the impact of unemployment on education participation in England is mixed. Studies based on time series generally find a significant impact from local unemployment on education participation. Pissarides (1981) found that youth unemployment is not significantly related to education enrolment rates but that *adult* unemployment increases male enrolment rates. Positive effects on education participation from higher *youth* unemployment rates were found by Whitfield and Wilson (1991) and McVicar and Rice (2001) for later periods. Clark (2011), using a 30 year panel (1975-2005) of regional data to exploit the variation in staying-on rates and unemployment over time and between regions, found even larger positive effects from local youth unemployment on participation rates.

However, the evidence from individual micro-data is less clear. Micklewright et al (1990) fail to find any significant impact from local unemployment rates on the decision to stay on at school whilst Rice (1999) found a positive impact from unemployment rates on education participation largely for young males with weaker academic qualifications.

The level of local wages may also impact on the choice between continuing in education and seeking employment. Higher wages for skilled occupations imply higher returns to education and thus increase the expected benefits of additional years of schooling. This would encourage students to remain in education post 16. By contrast, higher wages for school leavers increase the opportunity costs of schooling and may therefore act as an incentive to enter the labour market earlier. Dickerson and Jones (2004) argue that this effect is small in the context of a very unequal distribution of attainment, as relatively few individuals would be affected at the margin by changes in the expected wages[3].

Frayne and Goodman (2004) look specifically at the effect of introducing a minimum wage for 16 and 17 year olds in England on the demand for education. They estimate a structural model of work and schooling decisions amongst 16 to 17 year olds, in which the decision to take up a job and the decision to remain in school depend upon the potential wage, and a set of other characteristics (such as gender, previous educational attainment (though their measures here are limited to GCSEs at age 16), parental characteristics and other financial incentives, such as EMA entitlement if in school). Their estimates show a low elasticity of labour supply to wages. They calculate that introducing a minimum wage in October 2004 at £3 or £3.50 per hour would make little difference to the number of young people wanting to work, either by leaving school and joining the labour market, or by combining school and part-time work.

A recent work by Rice (2010) suggests a more sizeable impact of the minimum wage on enrolment in schooling, using the introduction of the national minimum wage in the UK in April 1999 as a 'natural experiment'. Her identification strategy is based in the fact that that among young people in the investigated school-year cohort, only those who were aged 18 years in spring 1999 were eligible to receive the national minimum wage, while those aged only 17 years were not eligible. She thus compares participation in post-compulsory schooling for the two groups, both before and after the enactment of the legislation, exploiting the exogenous assignment to the treatment determined by being either side of a fixed age threshold to uncover a causal effect[4]. Her results reveal that the average effect of the minimum wage on enrolment in post compulsory schooling is negligible, but the eligibility for the minimum wage significantly reduces the probability of participation in post-compulsory schooling for young people living in areas where the national minimum is high relative to local earnings.

Most studies concur that the biggest driver of education participation is prior achievement. This is shown for the UK at a macro level (McVicar and Rice, 2001; Andrews and Bradley, 1997) and at a micro level (Rice, 1999; Micklewright, 1989; Dickerson and Jones, 2004). Micro studies also find that parental social class and education have a major impact on the participation decision (Micklewright, 1989; Rice, 1999; Dickerson and Jones, 2004). Academic achievement and family background have also been found to be important in determining whether pupils invest in post compulsory education in other countries (see for example Petrongolo and San Segundo, 2002 for Spain; Kane, 1994 for the United States; and Kodde and Ritzen, 1988 for the Netherlands).

In summary, there is some empirical evidence of a relationship between labour market conditions and young people's education participation decisions. However, micro analyses of this issue have been limited in a number of ways. Firstly, they have often relied on data that lacks accurate historical information on each child's prior achievement. For example, often the only measure of prior achievement available is each student's GCSE scores taken at age 16. We use rich longitudinal data from the Longitudinal Study of Young People (LSYPE) linked to school administrative data and the latter provides us with a full record of each young person's prior achievement (from primary school through to GCSE) and details of the school attended. The data include test score information from age 11 for example (Key Stage 2 test scores) [5]. The LSYPE also have an extremely comprehensive set of family background and other controls for our model, including pupil and parent attitude and aspiration information. This combination of rich survey and complete administrative data means that our models can better control for the range of factors that may influence choices at age 16 and specifically we can condition for the child's educational trajectory prior to making the decision to remain on in education (or not).

Another major methodological issue in the literature is estimation technique. In reality of course a pupil does not have a dichotomous choice (to remain in education or not) but rather a whole range of options. For instance, they need to decide whether or not to remain in education and then, having made the decision to continue in education, whether to pursue part or full time study. This requires something more sophisticated than a simple probit model. For example, Andrews and Bradley (1997) show that using a binary model of whether the person remains in full time education or not is too simplistic. Instead they model a richer menu of school-leaver choices, using a multinomial logistic framework to examine the determinants of six possible first destination states[6]. The problem with this approach is that

the multinomial logit requires us to make the usual IIA assumption, which in this case is highly problematic. We therefore add to the literature by estimating instead a nested logit which takes account sequencing in the decision making process and does not require the strong IIA assumption. Our application of this model and its advantages are described below.

II. MODEL SPECIFICATION

As has been said, previous studies considering the question of what determines the staying-on rates in post-compulsory education have focussed on either a simple binary structure decision process of remaining within education or not (see Micklewright (1989); Micklewright et al (1990), Rice (1987), (1999)), or a multinomial logit (MNL) specification allowing for multiple unordered outcomes (see Andrews and Bradley (1997); Petrongolo and San Segundo (2002); Dickerson and Jones (2004)). Although the limitations of the first approach in relation to the range of post-compulsory choices facing pupils at 16 are clear, the restrictions of the second (the MNL) are less immediately obvious.

Although the MNL allows the modelling of the staying-on decision across more than two post-compulsory choices, a fundamental assumption of the modelling process is that there is independence of irrelevant alternatives (IIA). The IIA assumption essentially requires that an individual's evaluation of one alternative relative to another alternative should not change if a third (irrelevant) alternative is added to or dropped from the choice set. This assumption is forced in the MNL model because the errors are set to be independent and identically distributed. This assumption seems unrealistic in the case of decisions between different options that are clearly interrelated (and indeed empirically we show this to be the case).

Instead we propose using the nested logit model, which will incorporate the structured (and potentially sequential) decision making process pupils engage with in relation to the post-compulsory schooling decision. This model not only incorporates four potential post-compulsory schooling outcomes at age 16. The four post-compulsory education alternative outcomes that pupils at age 16 are considered to choose between are:

Continuing studying at a school or college full time (FTED)

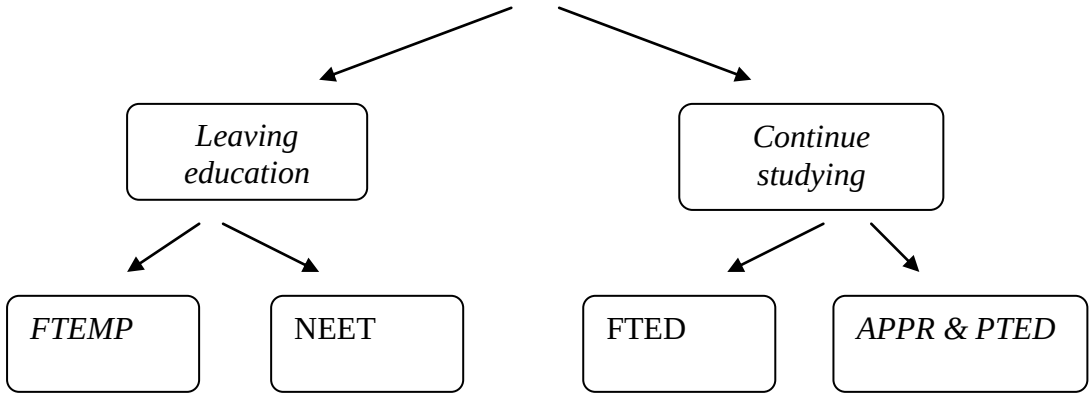
Leaving education for full-time paid work (FTEMP)

Continuing studying part time education (possibly with a part time job) or within an apprenticeship (APPR & PTED)

Leaving education for unemployment or other out of the labour force activity without training (NEET).

The nested logit also has the advantage that it relaxes the IIA assumption across each branch of the nested logit. An alternative approach to relaxing the IIA assumption is to use a multinomial probit and to incorporate in the model alternative-specific variables. In this alternative specific multinomial probit model (ASMNPM) the inclusion of such variables allows us to relax the assumption that the errors are uncorrelated, which eliminates the IIA restriction. Alternative specific variables are necessary to identify the error correlation. We test the robustness of our results using this ASMNPM model and in every case we reject the IIA restriction. We were however, unable to get the model to converge for our preferred specification and hence we present results for the nested logit only. The nested logit model decision tree structure is constructed as the following:

The Nested Logit Post-Compulsory Education Model



In the figure above, the four post-compulsory schooling decision choices (an m-choice model, where m=4) is broken into two limbs ($j = 1, 2$) and then two further branches. Pupils firstly consider whether to continue studying in the post-compulsory period and then if they decide to continue, they choose between studying full-time or undertaking part time education/within an apprenticeship. If the pupil decides to leave education they then face the alternatives of working full-time or being unemployed / out of the labour force and without training.

This decision process can be presented within the additive random utility model (ARUM) framework whereby the individual will choose from one of the four unordered outcomes - FTED, FTEMP, APPR & PTED or NEET - depending upon whichever provides the highest utility for the individual pupil.

Formally, and following the exposition and notation in Cameron and Trivedi (2005) pp.508-510, we can write the utility from the alternative in the j th of J limbs and the k th of K_j branches as the following with the individual pupil subscript i suppressed:

$$U_{jk} = V_{jk} + \varepsilon_{jk} \ , k = 1, 2, ..., K_j, \ j = 1, 2, ..., J$$

where

$$V_{jk} = \mathrm{z}' \alpha_j + \mathrm{x}' \beta_{jk}$$

and α_j varies over limbs and β_{jk} over limbs and branches. These regressors are all case or individual specific. In addition we include a variable that is specific to the four alternative outcomes that the individual can choose, therefore being both case and alternative specific.

$$V_{jk} = \mathrm{z}' \alpha_j + \mathrm{x}' \beta_{jk} + \mathrm{w}'_{jk} \varphi$$

An example of a w_{jk} variable is the average expected return that each m-choice of outcome would provide to the individual given their attainment (or ability). Further w_{jk} is not just an example of a case and alternative specific variable, it is a theoretically important measure that enables us to explicitly test human capital theory in relation to what determines young people's investment decisions. It allows us a formal test of whether expected (wage) returns impact significantly on the choice of post-compulsory schooling activity. Section 4 contains a discussion of how this variable was constructed using data from the 1970 British Cohort Study and the individual pupil's position in the ability distribution as defined by GSCE scores in the LSYPE. However, the underlying assumption here is that youths assess the wage returns from each of the four competing post-compulsory choices and then choose that which provides the best feasible option given their position in the ability distribution, whether this is actually the process by which youths form their expectations about education returns is an interesting question (see Manski (1993) for an excellent discussion on this point).

The joint probability of being on limb j and branch k is given by:

$$p_{jk} = p_j \times p_{k|j}$$

Assuming that the joint distribution of the errors is the generalised extreme value (GEV) distribution the nested logit can be derived as in McFadden (1978) as:

$$p_{jk} = p_j \times p_{k|j} = \frac{\exp\left(\mathrm{z}_j^{'}\alpha + \rho_j I_j\right)}{\sum_{m=1}^{J}\exp\left(\mathrm{z}_m^{'}\alpha + \rho_m I_m\right)} \times \frac{\exp\left(\mathrm{x}_{jk}^{'}\beta_j / \rho_j\right)}{\sum_{l=1}^{K_j}\exp\left(\mathrm{x}_{jk}^{'}\beta_j / \rho_j\right)}$$

where ρ_j is a function of the correlation between ε_{jk} and ε_{jl}, and

$I_j = \ln\left(\sum_{l=1}^{K_j}\exp(\mathrm{x}_{jk}^{'}\beta_j / \rho_j)\right)$ is called the inclusive value or the log-sum.

This model can then be estimated using either sequential estimation (the limited information maximum likelihood estimator) or (as is more efficient) with the full-information maximum likelihood estimator (FIML). We use the latter in this paper. The FIML estimator maximises the log likelihood function with respect to the parameters α, β_j and ρ_j. Estimation results for the nested logit decision tree and model discussed above are presented in the section 5.

III. DATA

The LSYPE is a survey of about 15,000 young people in England who were aged 13 and 14 in 2003/2004 and then followed over time on an annual basis. The survey covers the secondary school period until year 11 (that marks the end of compulsory schooling at age 16) and the wave 4 data, which we use in this paper, refers to the academic year 2006/07, when the young person has already made the decision on whether to stay in full time education or to start working.

As discussed earlier, the LSYPE is a very rich source of information on pupils' personal characteristics, attitudes, experiences, behaviours, expectation and aspirations as well as on family background, household composition and parents' characteristics and aspirations. It therefore constitutes an ideal dataset to study the key factors affecting young people's decisions on activities after the years of compulsory education.

We matched LSYPE data to National Pupil Database and Pupil Level Annual School Census (NPD/PLASC). This gives us information on pupils' scores in standard national tests (key stage tests), i.e. a historical record of pupils' achievement from primary school onwards and provides a far richer set of measures of prior attainment than has been possible hither to using English data.

The dependent variable is a categorical variable indicating four possible states for each young person at age 16/17, just after the end of compulsory schooling. As shown in Table 1 below, over three quarters of the cohort remains in full time education after age 16. A further 6.5% combine education and some kind of work. Only 6.6% of the cohort is employed on a full

time basis and almost 8% classified as NEET, i.e. not in education, employment or training, which makes it the 2nd largest destination group after full-time education. Figures 1 shows similar activity rates from recent periods of the 1995-2011 time series and how the trends have evolved over time.

Our key variables of interest are two measures of the state of the local labour market, assuming a relatively small geographical area constitutes a labour market for school leavers (i.e. a local authority). Specifically we include the age 16-19 local authority[7] unemployment rate, from the Labour Force Survey.[8] We test two competing hypotheses. The first hypothesis is that a high youth unemployment rate is likely to have a positive impact on the likelihood of the individual remaining in education as it reduces the opportunity costs of doing so. The alternative hypothesis is that high unemployment rates generally cause young people to anticipate high unemployment in the future and hence they expect a lower return to education. This would tend to reduce participation in post compulsory schooling. We also include the average age 16-21 wage level in the student's local authority using the Annual Survey of Hours and Earnings (ASHE). On the one hand, higher wages are likely to draw young people into the labour market by increasing the opportunity cost of study. On the other hand, higher returns to education make investment in education more worthwhile and hence encourage young people to remain in education. Hence the net effect of wages on education participation is ambiguous.

The nested logit model requires a variable that varies across options for the same individual. We created a variable that is specific to the different alternative outcomes that the person can choose and specific to the individual, namely the average expected *returns* that each labour market option provides, given individual ability. We do this using data from the British

Cohort Study (BCS), a longitudinal survey that follows the same group of people born in 1970 from birth into adulthood and provides rich information about cohort members' educational, social and economic circumstances. Essentially we created a measure of the expected gain from choosing each of the four transition options at age 16, based on the wages earned by those who actually chose each of these options in the BCS data. We did this taking into account that the expected wages from choosing each option are likely to vary according to individual ability. For each individual in our LSYPE sample we therefore calculated the average expected log wages for each potential option, where this was derived from actual wages observed at age 34 in the BCS data, for individuals with similar ability that have chosen the four different options at age 16. We divided the BCS sample into fifty quantiles of ability by looking at the distribution of the scores in cognitive tests taken at age 10. We therefore calculated average log wages in 200 cells (given by the 4 options and the 50 ability percentiles). In order to alleviate the problem of few observations per cell, which could lead to potentially imprecise measures of average wages, we created mean wages using a moving average such that for each percentile, the mean log wage is calculated considering that percentile and 4 percentiles below and above it (+/-4). We then merged the mean log wage to the LSYPE data by matching individuals in the same position of the ability distribution (defined by test scores at age 10 in BCS and by GSCE scores in LSYPE) and making the same choice at age 16.

As mentioned above, the key advantage of our data is that we have information on pupil's attainment throughout their schooling. We include in our model measures of pupils' past attainment at school, which has been identified by previous literature as a key determinant of choices at age 16 (see for example Dickerson and Jones, 2004; Rice, 1999). In particular, we use the NPD/PLASC dataset to control for early achievement at age 11 (Key Stage 2) which

we use to identify lower and higher ability pupils when estimating interaction effects between labour market conditions and the young person's prior ability. We also create a measure of academic achievement at Key Stage 4 (General Certificate of Secondary Education or GCSE), which is the national exam taken at age 16 before leaving compulsory school. This measure is a synthetic continuous score averaged across different subjects. In particular, we use a capped average point score[9] that takes into account the pupil's eight highest grades. This score has been standardised within the LSYPE total sample in wave 3.

In terms of family background, parental income is likely to affect pupils' decisions, since parental income is the primary source of finance when credit markets are imperfect (Kodde and Ritzen, 1985) and parents with different incomes may be differently willing or able to subsidise costs during post compulsory education. Unfortunately LSYPE data do not provide a clean measure of parental income. Therefore we use pupils' eligibility for Free School Meals (FSM) to proxy family poverty status (Hobbs and Vignoles, 2007) and a number of dummies describing parental occupation[10] as an indicator of parental income. Parental education may also be a key factor affecting the schooling decisions of youths, since this affects children's preferences for education and may moreover proxy permanent family income better than actual income (see Petrongolo and San Segundo, 2002). We measure parental education using two dummies indicating whether the father and mother have a degree.

The LSYPE dataset also includes a vast array of detailed questions relating to the attitudes, values and behaviour of both parents and pupils, some of which are likely to affect the post compulsory schooling decision. Among these attitude variables, we use a variable describing pupils' attitudes toward school in year 11 (last year of compulsory school), and a variable

capturing parents' expectations. The first one is obtained from LSYPE interviews in 2006 and it sums the answers that the young person has given to 12 attitudinal questions relating to how they feel about school[11]. The variable ranges from 0 – 48 by assigning values to the variables (using a Likert scale) according to whether they were positive or negative statements. The higher the score, the more positive is the young person's attitude to school. Parental expectations are measured by a dummy variable indicating whether the parent expected the pupil to stay on in full time education when the pupil was in year 9. Including these attitudinal variables is intended to account for what would otherwise be unobserved pupil heterogeneity that might be correlated with staying on.

We also included measures of the child's ethnicity but again these were all insignificant in the analysis and hence for parsimony are not included in the results presented (Given the challenges of estimating a nested logit, a parsimonious specification is essential. We therefore drop all variables found to be consistently insignificant.). A measure of whether the child has English as an Additional Language is included in the model as it was sometimes significant in the specification. Children for whom English is an additional language may face different barriers in the labour market or indeed in the school system and we want to control for this.

Previous work by Andrews and Bradley (1997) has also suggested that school factors may be important for the school leaving decision. We considered the effect of school size, school type and, as a peer effect, the proportion of pupils in the school staying on beyond the school leaving age. Only the proportion of pupils in the school staying on beyond school leaving age was ever significant and hence the other variables are not included in the model presented.

We also control for underlying attitudes towards work (or potentially opportunities for work) by including the number of hours the young people worked during term time in the year before the end of compulsory schooling. Lastly we control for regional differences in labour market opportunities and industrial structure by including regional dummy variables.

IV. RESULTS

For comparison purposes we present results using a range of models. Table 2 presents the basic binary decision of whether to leave or stay in education at the end of the compulsory period at age 16/17. The logit parameter estimates and average marginal effect are shown for both males and females separately and with standard errors robust to both heteroskedasticity and local authority clustering. Both the male and female estimates highlight the significance of educational attainment at GCSE, whether parents hold degrees, parental attitude to the child staying on at school and the young person's attitude to school. As our central research question is whether labour market conditions are another important driver of post 16 participation decisions, we test this by including the age 16-19 unemployment rate and age 16-21 wage rate at the local area level (local authority) in the logit. The findings show a lack of significance of the local authority (LA) unemployment and wage rates on the leave/stay decision, suggesting (at least within this simple model) that local labour market conditions do not affect the decision to invest further in education-based human capital.[12]

Tables 3 and 4 extend the simple binary decision process to incorporate the four choices of post-compulsory education (full-time education, apprenticeship and part-time education, full-time employment or NEET). The incorporation of the four distinct outcomes into the

modelling is both theoretically and empirically appealing as the choice set facing individuals is more complex than a simple binary choice. Presented estimates tend to support the earlier finding that educational attainment at GCSE, and positive parental and pupil attitude to school, are key drivers of the choice of full-time education over each of the other three choices (as the relative risk ratios are less than one). For example, if a parent wants their child to stay on at school the relative odds of choosing work rather than full-time education are reduced (for males) by 0.403. However the most interesting point of note is the significance of the impact of the local unemployment rate in the male post-compulsory education model (Table 4). For males, this finding suggests that higher local authority unemployment rates reduce the probability of pupils moving out of full-time education into full-time employment, consistent with an interpretation that difficult employment conditions encourage males to invest in education rather than seek employment. Interestingly this result is not found for females, indeed for females the direction of effect is opposite (relative risk ratio in excess of one) though insignificant. It is worth noting that using an alternative definition of labour market activity and NEET, where full-time employment is redefined as ’participating in the labour market’ (employed or unemployed) and NEET is instead defined as out of the labour market does not improve the significance of the local labour market effects.

Tables 5 and 6 present the results for the nested logit model for post-compulsory education. As before results are shown separately for females (Table 5) and males (Table 6). As has already been noted the advantage of the nested logit approach is that it allows us to not only model a wider range of options at age 16 simultaneously (as did the MNL) but does not require the IIA assumption to hold, as is the case of the conventional multinomial logit (as above).

In all nested logit models that we estimate, the likelihood ratio test for the IIA assumption within the nested logit model rejects the null at the 1% significance level. This result along with the formal tests of the IIA assumption reported for the MNL models (Tables 3 and 4) provide evidence to support our alternative modelling approach of using the nested logit. Indeed, not only does the choice of the nested logit appeal due to the question of the MNL IIA but it also provides us with a modelling structure which we believe more accurately represents this decision process faced by individuals. For Tables 5 and 6 the full information maximum likelihood (FIML) parameter estimates are reported and discussion of the estimates will focus on sign and significance. In Table 7 the marginal probabilities are reported for choosing a particular post-compulsory choice given an increase in the listed covariates.

The previous literature suggests quite definitively that a pupil's prior achievement (at key stage 4 – GCSE) is the main driver of his or her decision to continue in full time education past the age of 16 or not. We therefore include capped GCSE score in the first level equation along with the controls for whether the mother and father have degrees and whether the parent wants the student to stay at school. In the second level equation, identifying which of four labour market options a person takes once having made the decision to leave full time education or not, we include the full range of additional covariates including our labour market variables - which are the key variables of interest here.

As previously noted the nested logit model is identified by including a variable which varies across the four different outcome options. In our case this is the variable which measures the expected returns (wages) for the individual from the four different alternative options. The variable varies across individuals since the expected returns from each of the four different labour market options will vary by the young person's ability. We construct this "returns"

variable as outlined earlier in the data section. The coefficient on this variable is shown in the first row at the top of Tables 5 and 6 and is always positive and significant, indicating that in line with economic theory individuals are more likely to chose the option that yields the highest wage return. The structure of the nested logit model allows us to use a variable of this form which includes an underlying prediction of the wage returns from having chosen each of the m-choices at age 16/17 for each individual based on their position in the ability distribution. It is interesting to note that although the expected returns variable is positive and significant for both males and females the magnitude (and significance level) is greater for males, which would be consistent with males placing a higher emphasis on wage returns when selecting post-compulsory education activities than females.

The second panel of results from both Table 5 for females and Table 6 for males shows that prior achievement is negatively and significantly associated with the likelihood of leaving full time education at age 16. Students with higher GCSE scores are significantly less likely to leave full time education at the end of compulsory schooling than those with lower GCSE scores. This finding is robust to inclusion of whether the mother and father hold degrees and to whether the parent wants the student to stay on at school. Further these controls also show that parental educational aspirations and own educational attainment are negatively and significantly associated with the likelihood of leaving full-time education.

Moving on to the second level of the model, we focus on the factors correlated with the particular labour market outcome chosen by the young person. For males only, if a student was eligible for Free School Meals at secondary school, he is more likely to be NEET than remain in full time education, whereas for females the eligibility for free school meals seems

to impact upon the choice of full-time employment over full-time education rather than NEET.

We also found that young people who have English as an additional language are less likely to go into full time employment and more likely to remain in full time education. Whether this reflects a positive inclination to remain in full time education for children from families where English is an additional language or more negatively barriers that make it more difficult for such young people to find work is unclear. However, given work by Wilson et al. (2005) which suggests that children who have English as an additional language make more academic progress in secondary school, the fact that such children are then more likely to remain in full time education may suggest that the former explanation is more likely.

Another factor we considered was the role of schools. Generally school variables, such as school type and size were found to be insignificant in the model. Young males in schools where a higher proportion of students remain in full time education at the end of compulsory schooling are less likely to be in work, part time work or NEET as compared to being in full time education (though only significantly so for apprenticeship/part-time work). Young females in such schools are less likely to be in part time and full-time work as compared to being in full time education but the estimates were not significant. It is unclear whether this is a selection effect from sorting into schools, a positive peer effect or due to such schools being particularly effective in encouraging young people to remain in full time education (see Sacerdote (2001) and Lavy and Schlosser (2011) on peer effects).

We do not have data on young people's attitudes towards work, nor any measure of their social networks and ability to find work, all of which might influence their choices. However,

we do have an indicator of the number of hours of work the young person did, if any, prior to the end of compulsory schooling. Both males and females who work more in term time are less likely to be NEET and more likely to be in a part time or full time job as compared to being in full time education. It is not clear whether these are causal relationships, as individuals who intend to leave education at the end of compulsory schooling may be more inclined to work during compulsory schooling too. However, the results do at least suggest that young people who are in work during compulsory schooling are potentially less at risk of being NEET.

Our main variables of interest are the local unemployment rate and the local wage rate and here the results for males and females differ markedly. For females (Table 5) higher local unemployment rates are associated with a lower probability of continuing on in full time education and a greater chance of entering the labour market and being in full time employment. This is consistent with theoretical predictions that difficult labour market conditions lead to lower investment in education, with more young females consequently taking up full time employment. This occurs if young women invest less in education because they feel that poor labour market prospects (as proxied by local unemployment rates) will result in a lower return to any education investment they might make. However, we also find that females in areas with higher unemployment rates have a lower probability of being NEET relative to being in full time education. This suggests that difficult labour market conditions may have a countervailing effect for some young people, preventing them from becoming NEET by encouraging them to remain in full time education. In other words, young women who can secure a job might be more tempted to take it in bad labour market conditions whilst those who cannot find work remain in full time education to avoid being

NEET. It should be clearly noted though that neither for full-time employment or NEET is the local labour market unemployment rate formally significant.

Further the local wage rates are generally not significantly correlated with labour market choices for females either. The coefficient on the wage variable is negative for the full time employment option, hinting that higher wages are associated with a lower probability of being in full time employment. This latter finding might suggest support for the view that for females, high wages and good labour market conditions tend to encourage further investment in full time education.

In comparison for males (Table 6) high local unemployment rates are associated with a significantly lower probability of being in work. This suggests that high youth unemployment tends to keep males in full time education, the so called 'discouraged worker' effect. This is consistent with males making more investment in education when the opportunity cost of studying is low since the likelihood of getting or keeping a job is low. Males in areas with high unemployment also face a significantly higher probability of being NEET, suggesting that in difficult labour market conditions males who do leave full-time education then struggle to find work, perhaps because their achievement is too low to make further investments in education. We test this argument further using interaction effects between prior ability and local labour market conditions as described below in the section on robustness checks. For males, higher wages are also negatively associated with being in full time and apprenticeship/part-time employment but are again insignificant.[13]

Table 7 reports the marginal probabilities for the nested logits presented in Tables 5 and 6. The marginal probabilities are required for interpretation of the estimated nested logits and

show clearly the relatively greater importance of factors such as the longer-run returns (by age 30) to each post-compulsory choice, parental aspirations, pupil attainment and parental educational background in comparison to the effect of local labour market conditions. From a policy perspective these marginal probabilities highlight quite clearly that any concerns about local wage rates pulling pupils out of education are quite (on average) unfounded. To the extent that we can regard the evidence of the large impact of parental educational aspirations on the pupils' probability of remaining in full-time education as causal, government could potentially increase staying-on rates in full-time education by developing school-based methods for raising the educational aspirations of the pupil (e.g. greater careers advice, support and aspiration coaching).

Overall then the patterns of results from the nested logit model suggest the clear importance of the future expected returns to the post-compulsory choice, along with pupil attainment, parental educational background and aspirations, as the primary drivers of the post-compulsory education choice.

Robustness checks

Although the findings so far suggest that labour labour market conditions are not, on average, significant determinants of the post-compulsory education decisions for pupils at age 16/17, it could be that these variables impact heterogeneously across the pupil population based on ability/attainment. As such we also explored a number of possible interactions, starting with interactions between local labour market conditions and the pupil's prior achievement as reported in Table 8.[14] We wanted to determine whether labour market conditions impact different types of pupils heterogeneously, with lower achieving pupils being more influenced by labour market conditions. We first included an interaction between a dummy variable

indicating if the individual was in the bottom decile of the age 11 key stage 2 test score distribution and the two labour market variables. For females the inclusion of the interaction terms did not alter the findings described above (as in Table 5). For males, the estimates in Table 8 in the lower panel show some evidence that the local labour market wage rates have a greater impact on those pupils in the bottom 10% of the ability distribution at age 11, pulling them into being NEET rather than full-time education. Although only significant at 5% this finding provides some evidence that the local wage rates impact heterogeneously across (male) pupils on their post-compulsory education decisions, based on pupil educational attainment.

We also considered interactions between labour market conditions and the socio-economic background of the individual (not shown). Specifically we included interactions between the labour market variables and a dummy variable which took the value of one if the young person had a graduate parent. These interaction terms were always insignificant, suggesting the patterns we observe do not vary significantly by socio-economic background.

We then undertook a number of additional robustness checks to our specification. Firstly, we confirmed that results in Tables 5 and 6 are robust to inclusion of regional dummies. Secondly, the results above are from models which include the young person's GCSE score as the variable in the first level equation which predicts the school leaving decision. Potentially the individual's GCSE score is endogenous in that the person may work more or less hard at GCSE depending on what choice s/he intends to make post 16. We therefore checked the robustness of our findings by using the person's key stage 2 test score to predict whether or not they leave full time education after the end of compulsory schooling instead of their GCSE scores. The key stage 2 test score more weakly predicts the school leaving

decision; however, reassuringly the coefficients on our labour market variables of interest have the same signs and significance in this alternative specification. The coefficients are also of similar magnitude. Thirdly, we explored the sensitivity of results to different definitions of the local labour market variables, aggregating to regional rather than local authority level and changing the age range for the wage variables. Broadly, for females the labour market variables remain insignificant regardless of data aggregation and definition. For males, using more aggregate data at regional level or unemployment and wage rates for different age groups results in insignificant coefficients on the labour market variables (Appendix Table A3).

VI. CONCLUDING REMARKS

This paper assesses the relative importance of local labour market conditions (defined by relative unemployment and wage rates) and pupil educational attainment as the primary determinants of the post-compulsory schooling decision. Using the Longitudinal Study of Young People in England (LSYPE), rich socioeconomic data are combined with individual-level pupil attainment and school-based data available through restricted access national databases (National Pupil Database, the Pupil Level Annual School Census and the LEA and School Information Service), and local labour market data (Annual Survey of Hours and Earnings and Annual Population Survey). We present our preferred model, the nested logit for the post-compulsory education decision. This model formally incorporates the structured and sequential decision process pupils engage with in relation to the schooling decision and relaxes the IIA assumption within branches.

Our findings show that a primary driver of the schooling decision is pupil educational attainment, parental aspirations and own educational background. This finding holds across different specifications and models. We also found that the framework chosen for modelling the decisions taken at age 16 was important. In simple binary models of the school leaving decision, or indeed a multinomial logit model of the four options available at age 16, local labour market conditions were generally not significant drivers of pupils' choices. However, using our preferred nested logit model, which overcomes some of the methodological problems with these alternative approaches, we found that local labour market conditions do impact on choices but differently for males and females. This last point is consistent with the heterogeneous impacts found by some previous work in this area (e.g. Pissarides (1981) and Rice (1999)).

For males we find evidence that higher unemployment rates keep males in full time education whereas there is little impact from wages. For females in comparison higher unemployment tends to discourage them from making further investment in education and hence draw them into the labour market though the result was not formally significant.

These findings have clear implications for policy. In particular, the notable lack of significance of local labour market wages on the post-compulsory schooling decision suggests that the extension of the UK national minimum wages to 16/17 year olds in October 2004 might have had a limited effect, if any, in terms of 'pulling' students out from post-compulsory education. In addition, for males any such minimum wage effects are likely to have been more than counter balanced by the 'push' toward post-compulsory schooling caused by the rise in youth unemployment during the late noughties recession.

Our work spanned the introduction of the Educational Maintenance Allowance (EMA) which provided a conditional cash transfer to 16-18 year olds staying in full-time education. One question then is whether the lack of significance of local labour market wages on post-compulsory education choices will remain as the direct financial incentive of the EMA to remain in full time education is removed. If the EMA encouraged post-compulsory education participation then abolition should reduce participation, yet the abolition of the EMA has happened (in 2011) in a difficult economic climate (in terms of high unemployment) so for males at least this may provide the counter effect to the EMA abolition - whether this will be the case for females is open to debate. Further, given the changes in compulsory education that will occur in England in 2013 (raising the education participation age from 16 to 18) and the current background of historically high youth unemployment, one interesting future research question is which choice of activity in the 16-18 year olds education period is more likely to secure long-term future employment.

In summary, our work suggests that local labour market conditions *can* have a significant impact on pupils' decisions, though this will depend on modelling choices, specifications and pupil characteristics and, in terms of policy conclusions, it is clear that the real drivers of decision making at age 16 are educational attainment, aspirations and expectations of and for the child.

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NOTES

[1] This paper is an extension of some of our previous work in De Coulon, Meschi, Swaffield, Vignoles and Wadsworth, 2009.

[2] Education may have consumption value for some students who enjoy learning.

[3] Their idea is that for all pupils with high ability, the value of remaining in full-time education (given their high probability of success in further education) is still greater than any potential increase in their wages while they are 16 and 17 years old.

[4] Under the assumptions that eligibility for the national minimum wage is the only source of discontinuity in behaviour at age 18 years and that the introduction of the NMW has no impact on the younger age group (no spillovers).

[5] The Key Stage tests are national achievement tests performed by all children in state schools. The tests are anonymised and marked by external graders.

[6] They distinguish between: staying on and studying for academic qualifications; staying on and studying for vocational qualifications; leaving to employment associated with on the job training; leaving to employment associated with general skills training; leaving for general skills training; and unemployed.

[7] Local authorities are part of the English local government system. They are geographical areas of on average 150,000-300,000 people which are run by elected bodies and are responsibility for local services, such as education.

[8] Further tests for sensitivity of estimates to different geographical aggregation on the unemployment and wages variables are illustrated (for males) in table A.3.

[9] According to the new scoring system introduced between 2002–03 and 2003–04, 58 points were awarded for an A*, 52 for an A, 46 for a B, 40 for a C, 34 for a D, 28 for a E, 22 for F, and 16 for a G. Marks are allocated for standard GCSEs, but also for all qualifications approved for use pre-16, such as entry-level qualifications, vocational qualifications, and AS levels taken early.

[10] These dummies turn out to be insignificant once we include all the other variables in the model, particularly parental education, and hence we omit them in the results tables.

[11] The specific items: are 1) I am happy when I am at school ; 2) School is a waste of time for me; 3)School work is worth doing; 4) Most of the time I don't want to go to school; 5) People think my school is a good school; 6) On the whole I like being at school; 7) I work as hard as I can in school; 8) In a lesson, I often count the minutes till it ends; 9) I am bored in lessons; 10) The work I do in lessons is a waste of time; 11) The work I do in lessons is interesting to me; 12) I get good marks for my work. For each of these items pupils have to say whether they a) strongly agree; b) agree; c) disagree; or d) strongly disagree. For further details see the LSYPE user guide, available at

http://www.data-archive.ac.uk/doc/5545/mrdoc/pdf/5545wave_three_documentation.pdf

[12] Tables A.1 and A.2 further investigate the determinants of choosing full-time education over each of the other three activity outcomes separately. Again the dominance of parental attitudes, educational attainment and pupil attitude to school are seen to significantly determine the choice of full-time education over other options.

[13] It is worth noting that by including the set of regional dummies we identify our labour market effects through exploiting variations within rather than between regions. This could potentially explain the low significance of the labour market variables; however robustness checks excluding the regional dummies do not alter the significance of the local labour market effects."

[14] Interactions between attainment controls for the bottom 20%, 25% of the ability/attainment distribution were investigated but were not significant. Further, neither were interactions between the local labour market conditions and the Free School Meal control (a proxy for low family incomes).

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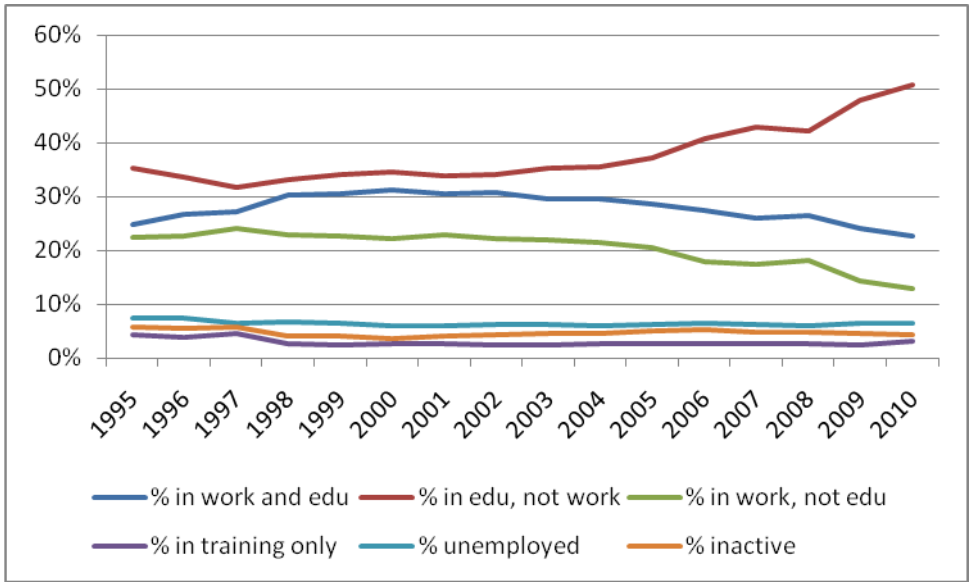
Figure 1: Activity rates (annual) time series 1995-2011 of 16-18 years



Source: UK Labour Force Survey, Annual 1995-2011

Table 1

Economic activity status at age 16/17, (LSYPE)

Economic activity	Full sample	Female	Male	Father has degree	Father has no degree	5-GCSE A*-C	Less than 5-GCSE A*-C
Full time education (FTED)	79.09	83.48	74.85	94.42	76.51	92.52	61.59
Part time & apprenticeship (APPR&PTED)	6.49	4.34	8.57	1.97	7.25	2.62	11.53
Full time employment (FTEMP)	6.60	4.88	8.26	1.42	7.47	2.57	11.86
Unemployed & other (NEET)	7.82	7.29	8.32	2.19	8.77	2.29	15.02
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of observations	6,333	3,112	3,211	914	5,419	3,584	2,749

Table 2

Probability of leaving education at the end of compulsory period at age 16/17

Logit	Coefficient estimate	Average marginal effect	Coefficient estimate	Average marginal effect
	Female		Male	
Key stage 4 (GCSE) standardized score	-0.843 (0.108)***	-0.070	-0.763 (0.101)***	-0.080
Mother has degree	-0.913 (0.441)**	-0.076	-0.232 (0.261)	-0.024
Father has degree	-0.601 (0.303)**	-0.050	-0.767 (0.248)***	-0.080
Log(unemployment LA rate age 16-19)	-0.136 (0.176)	-0.011	-0.080 (0.141)	-0.008
Log (average LA wages - age 16-21)	-1.115 (1.083)	-0.092	-0.981 (0.924)	-0.103
Whether parent wants student to stay at school	-0.525 (0.173)***	-0.044	-0.483 (0.119)***	-0.051
Whether has 5 GCSEs at A*-C	-0.858 (0.207)***	-0.071	-0.669 (0.139)***	-0.070
Attitude to school (scale)	-0.042 (0.010)***	-0.003	-0.044 (0.007)***	-0.005
Free school meals	-0.102 (0.250)	-0.008	0.165 (0.210)	0.017
Whether English as additional language	-0.300 (0.333)	-0.025	-1.346 (0.256)***	-0.141
School % of pupils staying in FTED	-0.015 (0.008)*	-0.001	-0.015 (0.006)**	-0.002
Number of hours worked during school term	0.055 (0.016)***	0.005	0.027 (0.012)**	0.003
Regional dummies	**yes**		**yes**	
Observations	3,112		3,221	
log likelihood	-869		-1096	
Wald test	623.94***		700.63***	

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1

Table 3
MNL relative risk ratios of the Post-Compulsory Education Model
(Females aged 16/17)

Relative Risk Ratios	APPR & PTED	FTEMP	NEET
Key stage 4 (GCSE) standardized score	0.581	0.388	0.388
	(0.120)***	(0.060)***	(0.056)***
Mother has degree	0.935	0.497	0.314
	(0.359)	(0.269)	(0.195)*
Father has degree	0.530	0.479	0.571
	(0.210)	(0.209)*	(0.214)
Log(unemployment LA rate age 16-19)	1.123	1.383	0.650
	(0.266)	(0.318)	(0.153)*
Log (average LA wages - age 16-21)	15.768	0.830	0.334
	(33.76)	(1.569)	(0.485)
Whether has 5 GCSEs at A*-C	0.307	0.480	0.369
	(0.091)***	(0.122)***	(0.103)***
Whether parent wants student to stay at school	0.500	0.526	0.523
	(0.097)***	(0.112)***	(0.127)***
Attitude to school (scale)	0.955	0.957	0.948
	(0.013)***	(0.014)***	(0.009)***
Free school meals	0.985	0.785	0.938
	(0.283)	(0.316)	(0.258)
Whether English as additional language	0.918	0.381	0.940
	(0.419)	(0.233)	(0.334)
School % of pupils staying in FTED	0.993	0.991	0.980
	(0.010)	(0.011)	(0.010)**
Number of hours worked during school term	1.049	1.097	1.032
	(0.026)**	(0.022)***	(0.024)
Regional dummies	**yes**	**yes**	**yes**
Observations	3,112	3,112	3,112
log likelihood	-1534	-1534	-1534
Wald test	1900.66***	1900.66***	1900.66***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1
3. Specification tests (Wald and LR tests) provide mixed results on whether the alternatives can be combined. The Small-Hsiao test for the IIA assumption rejects the null of the odds being independent of other alternatives for two of the three cases. The Hausman test of the IIA assumption is not valid as the asymptotic assumptions are not met by the estimated model.

Table 4
MNL relative risk ratios of the Post-Compulsory Education Model (Males aged 16/17)

Relative Risk Ratios	**APPR & PTED**	**FTEMP**	**NEET**
Key stage 4 (GCSE) standardized score	0.734	0.388	0.460
	(0.103)**	(0.058)***	(0.057)***
Mother has degree	0.575	0.543	0.961
	(0.184)	(0.177)*	(0.328)
Father has degree	0.543	0.379	0.507
	(0.156)**	(0.157)**	(0.179)*
Log(unemployment LA rate age 16-19)	0.852	0.633	1.311
	(0.189)	(0.098)***	(0.285)
Log (average LA wages - age 16-21)	0.647	0.155	0.706
	(1.032)	(0.258)	(1.008)
Whether has 5 GCSEs at A*-C	0.349	0.556	0.380
	(0.067)***	(0.119)***	(0.081)***
Whether parent wants student to stay at school	0.367	0.403	0.559
	(0.059)***	(0.069)***	(0.087)***
Attitude to school (scale)	0.953	0.947	0.941
	(0.008)***	(0.009)***	(0.009)***
Free school meals	1.056	0.601	1.567
	(2.94)	(0.256)	(0.347)**
Whether English as additional language	1.079	0.113	0.310
	(0.387)	(0.088)***	(0.085)***
School % of pupils staying in FTED	0.983	0.977	0.984
	(0.007)**	(0.009)***	(0.008)**
Number of hours worked during school term	1.040	1.075	0.986
	(0.018)**	(0.016)***	(0.024)
Regional dummies	**yes**	**yes**	**yes**
Observations	3,221	3,221	3,221
log likelihood	-2119	-2119	-2119
Wald test	3831.43***	3831.43***	3831.43***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1
3. Specification tests (Wald and LR tests) reject the null hypothesis of combining alternatives at less than 1%. The Small-Hsiao test for the IIA assumption does not reject the null of the odds being independent of other alternatives. The Hausman test of the IIA assumption is not valid as the asymptotic assumptions are not met by the estimated model.

Table 5
FIML Nested Logit parameter estimates of the Post-Compulsory Education Model (Females aged 16/17)

	APPR & PTED	FTEMP	NEET
Individual & alternative specific identifier			
Expected returns to post-compulsory activity	4.835	4.835	4.835
	(2.155)**	(2.155)**	(2.155)**
Level 1 decision: Decision to leave education rather than stay			
Key stage 4 (GCSE) standardized score	-0.854	-0.854	-0.854
	(0.173)***	(0.173)***	(0.173)***
Mother has degree	-1.023	-1.023	-1.023
	(0.444)**	(0.444)**	(0.444)**
Father has degree	-0.649	-0.649	-0.649
	(0.300)**	(0.300)**	(0.300)**
Whether parent wants student to stay at school	-0.582	-0.582	-0.582
	(0.177)***	(0.177)***	(0.177)***
Level 2 decision: Choice of post-compulsory education activity in relation to base category of full-time education			
Log(unemployment LA rate age 16-19)	0.249	2.917	-2.313
	(0.249)	(2.167)	(1.458)
Log (average LA wages - age 16-21)	2.057	-8.693	5.415
	(2.104)	(11.643)	(7.896)
Attitude to school (scale)	-0.071	-0.100	-0.012
	(0.047)	(0.066)	(0.048)
Free school meals	0.249	1.107	-0.970
	(0.300)	(1.805)**	(1.192)
Whether English as additional language	0.159	-7.311	4.271
	(0.479)	(3.002)	(1.787)
School % of pupils staying in FTED	-0.021	-0.063	0.013
	(0.015)	(0.065)	(0.048)
Number of hours worked during school term	0.040	0.492	-0.323
	(0.036)	(0.299)*	(0.235)
Regional dummies	**yes**	**yes**	**yes**
Observations	12,448	12,448	12,448
LR test for IIA	29.20***	29.20***	29.20***
log likelihood	-1571.94	-1571.94	-1571.94
Wald test	1006.61***	1006.61***	1006.61***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. LR tests for IIA formally test whether the nested logit (NL) reduces to the MNL and shows a strong rejection of this restriction in favour of the NL.
3. *** p<0.01, ** p<0.05, * p<0.1

Table 6
FIML Nested Logit parameter estimates of the Post-Compulsory Education Model
(Males aged 16/17)

	APPR & PTED	FTEMP	NEET
Individual & alternative specific identifier			
Expected returns to post-compulsory activity	5.375	5.375	5.375
	(1.246) ***	(1.246) ***	(1.246) ***
Level 1 decision: Decision to leave education rather than stay			
Key stage 4 (GCSE) standardized score	-0.697	-0.697	-0.697
	(0.104)***	(0.104)***	(0.104)***
Mother has degree	-0.211	-0.211	-0.211
	(0.248)***	(0.248)***	(0.248)***
Father has degree	-0.828	-0.828	-0.828
	(0.248)***	(0.248)***	(0.248)***
Whether parent wants student to stay at school	-0.493	-0.493	-0.493
	(0.114)***	(0.114)***	(0.114)***
Level 2 decision:			
Choice of post-compulsory education activity in relation to base category of full-time education			
Log(unemployment LA rate age 16-19)	-0.198	-1.119**	1.088*
	(0.479)	(0.458)	(0.574)
Log (average LA wages - age 16-21)	-2.491	-6.347	2.554
	(3.252)	(4.361)	(0.61)
Attitude to school (scale)	-0.133	-0.072	-0.074
	(0.059)**	(0.023)***	(0.023)***
Free school meals	0.143	-1.431	1.048
	(0.472)	(1.085)	(0.557)*
Whether English as additional language	0.652	-5.570	-0.141
	(0.742)	(3.318)	(1.006)
School % of pupils staying in FTED	-0.065	-0.030	-0.029
	(0.029)**	(0.018)	(0.019)
Number of hours worked during school term	0.095	0.167	-0.134
	(0.032)	(0.063)	(0.098)
Regional dummies	**yes**	**yes**	**Yes**
Observations	12,884	12,884	12,884
LR test for IIA	9.77***	9.77***	9.77***
log likelihood	-2206	-2206	-2206
Wald test	1572.13***	1572.13***	1572.13***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. LR tests for IIA formally test whether the nested logit (NL) reduces to the MNL and shows a strong rejection of this restriction in favour of the NL.
3. *** p<0.01, ** p<0.05, * p<0.1

Table 7
FIML Nested Logit Post-Compulsory Education Model marginal probabilities (aged 16/17)

Impact on the probability of choosing a particular post-compulsory choice given an increase in the:

	Return to choice of full-time education	Return to choice of Apprentice &/or PT education	Return to choice of FT work	Return to choice of NEET	Key stage 4 (GCSE) standardized score	Mother has degree	Father has degree	Whether parent wants student to stay at school	LA unemployment rate age 16-19	LA average wage rate age 16-21
Female										
Full-time education	0.057	-0.027	-0.020	-0.031	0.041	0.059	0.041	0.048	-0.002	-0.004
Apprentice &/or PT education	-0.017	0.034	-0.002	-0.003	0.005	0.007	0.004	0.005	0.005	0.007
FT work	-0.016	-0.003	0.011	0.012	-0.019	-0.027	-0.019	-0.022	0.005	-0.003
NEET	-0.024	-0.004	0.011	0.022	-0.027	-0.039	-0.027	-0.031	-0.008	0.001
Male										
Full-time education	0.067	-0.018	-0.032	-0.033	0.043	0.017	0.060	0.045	-0.001	0.013
Apprentice &/or PT education	-0.015	0.032	-0.007	-0.006	0.010	0.004	0.014	0.010	-0.004	-0.004
FT work	-0.025	-0.007	0.029	0.010	-0.027	-0.011	-0.037	-0.027	-0.009	-0.011
NEET	-0.026	-0.007	0.010	0.029	-0.027	-0.011	-0.037	-0.028	0.014	0.002

Notes:
1. Table 7 is constructed from the nested logit estimates of the Post-Compulsory Education Model shown in Tables 5 and 6 and show the marginal probabilities on the four outcomes (Full-time education, Apprentice &/or PT education, FT work & NEET) for an increase (a one standard deviation increase for continuous variables and a switch from zero to one for binary variables) for each of the variables listed at the head of each table column.

Table 8
Estimation of the post-compulsory education model with interaction terms between labour market controls and low ability
(aged 16/17)

	APPR & PTED	FTEMP	NEET
Female Nested Logit (FIML parameter estimates)			
Log(unemployment LA rate age 16-19)	0.284	2.953	-2.304
	(0.294)	(2.185)	(1.456)
Log(unemployment LA rate)*low ability	-0.349	-1.847	0.607
	(0.716)	(4.715)	(2.609)
Log (average LA wages - age 16-21)	2.495	-9.810	6.853
	(2.666)	(10.060)	(7.026)
Log (average LA wages)*low ability	-1.427	15.657	-12.602
	(4.415)	(18.618)	(10.441)
Low ability (bottom 10% of attainment) control	4.606	-23.632	21.329
	(9.401)	(37.135)	(19.359)
Observations	12,448	12,448	12,448
log likelihood	-1565.42	-1565.42	-1565.42
Wald test	1189.43***	1189.43***	1189.43***
Male Nested Logit (FIML parameter estimates)			
Log(unemployment LA rate age 16-19)	-0.232	-0.803	0.950
	(0.585)	(0.467)*	(0.577)*
Log(unemployment LA rate)*low ability	-0.473	-2.118	0.362
	(1.029)	(1.353)	(1.083)
Log (average LA wages - age 16-21)	-1.333	-4.507	-1.127
	(3.526)	(2.978)	(2.936)
Log (average LA wages)*low ability	-4.046	-7.928	15.362
	(7.070)	(12.525)	(7.904)**
Low ability (bottom 10% of attainment) control	11.578	20.885	-30.006
	(13.615)	(23.735)	(14.549)
Observations	12,884	12,884	12,884
log likelihood	-2188.90	-2188.90	-2188.90
Wald test	1557.20***	1557.20***	1557.20***

1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1
3. Additional controls include: regional dummies, Attitude to school (scale); whether parent wants student to stay at school; whether FSM; whether EAL; School % of pupils staying in FTED; Number of hours worked during school term.

APPENDIX

Table A.1

Probability of full-time education over each of the three alternative choices (Females aged 16/17)

Logit	FTed vs. App& PTed	FTed vs. FTemp	FTed vs. NEET
Key stage 4 (GCSE) standardized score	0.507 (0.218) **	0.913 (0.161)***	0.837 (0.136)***
Mother has degree	0.1000 (0.383)	0.719 (0.525)	1.148 (0.612)*
Father has degree	0.574 (0.395)	0.780 (0.425)*	0.596 (0.393)
Log(unemployment LA rate age 16-19)	-0.140 (0.256)	-0.255 (0.241)	0.412 (0.237)*
Log (average LA wages - age 16-21)	-2.735 (2.208)	0.618 (1.917)***	0.981 (1.537)
Whether parent wants student to stay at school	0.693 (0.197)***	0.626 (0.226)***	0.591 (0.235)**
Whether has 5 GCSEs at A*-C	1.195 (0.314)***	0.783 (0.267)***	1.079 (0.282)***
Attitude to school (scale)	0.045 (0.015)***	0.042 (0.014)***	0.048 (0.010)***
Free school meals	-0.074 (0.306)	0.206 (0.396)	0.077 (0.273)
Whether English as additional language	0.089 (0.458)	0.945 (0.583)	0.020 (0.356)
School % of pupils staying in FTED	0.008 (0.011)	0.007 (0.012)	0.016 (0.010)***
Number of hours worked during school term	-0.046 (0.026)*	-0.095 (0.022)***	-0.022 (0.022)
Regional dummies	Yes	Yes	Yes
Observations	2,733	2,750	2,825
log likelihood	-431.41	-442.13	-579.31
Wald test	366.23***	295.73***	459.87***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1

Table A.2

Probability of full-time education over each of the three alternative choices (Males aged 16/17)

Logit	FTed vs. App& PTed	FTed vs. FTemp	FTed vs. NEET
Key stage 4 (GCSE) standardized score	0.289 (0.150)*	0.813 (0.173)***	0.713 (0.128)***
Mother has degree	0.616 (0.316)*	0.676 (0.350)**	0.033 (0.033)
Father has degree	0.565 (0.284)**	0.904 (0.413)**	0.579* (0.343)*
Log(unemployment LA rate age 16-19)	0.119 (0.229)	0.403 (0.166)**	-0.364 (0.212)*
Log (average LA wages - age 16-21)	0.134 (1.581)	2.159 (1.521)	0.607 (1.364)
Whether parent wants student to stay at school	0.994 (0.169)***	0.970 (0.178)***	0.496 (0.158)***
Whether has 5 GCSEs at A*-C	1.509 (0.197)***	0.667 (0.209)	1.044 (0.222)***
Attitude to school (scale)	0.043 (0.009)***	0.051 (0.010)***	0.056 (0.010)***
Free school meals	-0.049 (0.279)	0.547 (0.494)	-0.395 (0.217)
Whether English as additional language	-0.003 (0.353)	2.100 (0.785)***	1.069 (0.270)***
School % of pupils staying in FTED	0.018 (0.007)***	0.023 (0.009)**	0.015* (0.009)*
Number of hours worked during school term	-0/038 (0.021)*	-0.063 (0.016)***	0.005 (0.027)
Regional dummies	Yes	Yes	Yes
Observations	2,687	2,677	2,679
log likelihood	-701.19	-581.13	-653.41
Wald test	524.32***	672.39***	474.01***

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering
2. *** p<0.01, ** p<0.05, * p<0.1

Table A.3
Nested logit sensitivity of local labour market effects to different age/geographical aggregation on the unemployment and wages variables
(Males aged 16/17)

	Logit	MNL		Nested logit	
Alternative specification I: Regional level					
Log (regional unemployment age 16-19)	-0.391	APPR & PTED	0.733	APPR & PTED	-0.453
	(0.238)*		(0.225)		(0.514)
		FTEMP	0.727	FTEMP	0.067
			(0.259)		(0.664)
		NEET	0.581	NEET	-0.864
			(1.68)*		(0.627)
Log (average regional wages - age 16-19)	0.793	APPR & PTED	57.789*	APPR & PTED	-3.380
	(1.983)		(133.20)		(3.346)
		FTEMP	2.881	FTEMP	-0.750
			(7.303)		(3.80)
		NEET	7.492	NEET	0.211
			(19.38)		(3.314)
Sample	3,221	3,221		3,221	
log likelihood	-1099.11	-2129.50		-2218.47	
Alternative specification II: Three age-based groupings for the wage measure					
Log(unemployment LA rate age 16-19)	-0.143 (0.136)	APPR & PTED	0.782	APPR & PTED	-0.194
			(0.159)		(0.499)
		FTEMP	0.610	FTEMP	-1.090
			(0.095)***		(0.452)
		NEET	1.150	NEET	0.992
			(0.244)		(0.573)
Log (average LA wages 16-17)	-0.404 (0.668)	APPR & PTED	0.360	APPR & PTED	-1.712
			(0.353)		(1.875)
		FTEMP	0.434	FTEMP	-2.000
			(0.347)		(2.180)
		NEET	0.618	NEET	0.498
			(0.541)		(2.583)
Log (average LA wages age 16-21)	-1.099 (1.181)	APPR & PTED	0.289	APPR & PTED	-1.960
			(0.557)		(3.584)
		FTEMP	0.156	FTEMP	-4.066
			(0.266)		(4.954)
		NEET	0.391	NEET	1.070
			(0.713)		(5.189)
Log (average LA wages age > 30)	0.966 (0.611)	APPR & PTED	5.325	APPR & PTED	-0.101
			(4.531)		(1.971)
		FTEMP	1.973	FTEMP	-0.891
			(1.722)		(1.785)
		NEET	5.378	NEET	1.325
			(4.537)**		(1.893)
Sample	3,194	3,194		12,776	
log likelihood	-1088.41	-2097.95		-2183.28	

Notes:
1. Standard errors presented in parentheses are robust to heteroskedasticity and LEA clustering.
2. *** p<0.01, ** p<0.05, * p<0.1
3. The full set of controls include: all explanatory variables in tables 2-6 and regional dummies, Attitude to school (scale); whether parent wants student to stay at school; whether FSM; whether EAL; School % of pupils staying in FTED; Number of hours worked during school term.
4. Reported logit estimates are parameter estimates, multinomial logit (MNL) estimates are relative risk ratios and nested logit estimates are FIML parameter estimates.