

# **The role of local labour market conditions and youth attainment on post-compulsory schooling decisions**

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## **Abstract**

This paper assesses the role of local labour market conditions and youth educational attainment as primary determinants of the post-compulsory schooling decision. Through the specification of a nested logit model, the restrictive IIA assumption inherent in the multinomial logit (MNL) model is relaxed across multiple unordered outcomes. Using data from Longitudinal Study of Young People in England (LSYPE), our analysis shows that the factors influencing schooling decisions differ for males and females. For females, on average, the key drivers of the schooling decision are expected wage returns based on youth educational attainment, attitudes to school and parental aspirations, rather than local labour market conditions. However, for males, higher local unemployment rates encourage greater investment in education.

## **Keywords:**

Post-compulsory education, local labour markets, parental aspirations, educational attainment, nested logit, multinomial logit

**JEL classification:** I21, J18, J24

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## 1. Introduction

Why do some youths 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<sup>1</sup>. However, the choices facing youths after the end of compulsory education (age 16 in England) are many and the factors determining their post 16 destinations are likely to be both complex and inter-related. This paper provides evidence on the factors influencing the decisions made by youth about their schooling and we focus particularly on how such influences vary by gender. Specifically, our overarching research question is whether local labour market conditions are an important driver of post 16 participation decisions and how this varies by gender. We exploit rich data from the fourth wave (2006/07) of the Longitudinal Study of Young People in England (LSYPE), coupled with individual-level attainment and school-based data available through national administrative databases<sup>2</sup> and local labour market data<sup>3</sup>. We use these data to investigate the role of local labour market conditions and youth educational attainment in the post-compulsory schooling decisions of males and females. In addition to contributing to the academic literature on the determinants of schooling decisions, the paper is relevant for policy-makers in the UK and beyond. In particular, understanding the determinants of post compulsory schooling choices and the role that local labour market conditions play, is crucial for the design of effective policy measures which seek to alter education leaving decisions.

Specifically, the contribution of this paper to the existing literature is threefold. Firstly, a nested logit model is proposed as an alternative to a multinomial logit model (MNL). The former can formally incorporate the structured and sequential decision-making process that youths may engage with in relation to the post-compulsory schooling decision, as well as relaxing the restrictive IIA assumption inherent in the MNL across multiple unordered outcomes, an issue we discuss in more detail in our methodology section below. Secondly, the analysis is based on using extremely rich socioeconomic data from the LSYPE, matched to local labour market data and to administrative data from the National Pupil Database and Pupil Level Annual School Census (NPD/PLASC), which provide a broad set of unusually high-quality measures of prior attainment. We argue that such high-quality data and an appropriate model specification allows identification of the determinants of the post-

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<sup>1</sup> See, among others, Micklewright (1989); Chowdry et al. (2013); Tumino and Taylor (2015).

<sup>2</sup> National Pupil Database, the Pupil Level Annual School Census and the LEA and School Information Service

<sup>3</sup> Annual Survey of Hours and Earnings and Annual Population Survey

compulsory decision in a more detailed manner than many previous analyses. Thirdly, the data has the scale necessary to consider whether the determinants of post compulsory schooling decisions vary by gender, a particularly important issue given the differential education participation rates of males and females (in this cohort, females are about 10 percentage points more likely to go on to higher education in the UK than males for example<sup>4</sup>). Further, understanding gender differences in behaviours is important given what we know about the gendered choices made in respect of curriculum options, vocational training and occupation, and their subsequent implications for the gender wage gap (Blau and Kahn, 2017; Bertrand, 2011; McMullin and Kilpi-Jakonen, 2015; Smyth and Steinmetz, 2015). Our work will therefore provide recent empirical evidence from England on gender differences in the determinants of education choices.

The analysis is conducted against a background of significant policy change in the UK, much of which has been focused on encouraging youth to remain in education longer and protecting them from low wages if they do enter the labour market. Whilst we cannot evaluate the impact of these policy changes, they do motivate our interest in improving our understanding of the determinants of post compulsory schooling decisions. For example, a youth minimum wage rate was introduced in the UK 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 altogether. 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 (Dickerson and Jones (2004); Rice (2010)) and the impact of extending the minimum wage to 16-17 year olds on their schooling choices (De Coulon *et al.* (2010); Crawford *et al.* (2011)). Since this paper examines the relationship between labour market conditions, namely youth wages and unemployment, and the decisions made by young people, it can potentially also inform the debate about whether any increase in the youth minimum wage is likely to impact on the schooling choices made.

The paper is organised as follows: Section 2 provides an overview of the English education system. Section 3 describes the theoretical framework and related literature. Section 4 presents the model framework. Section 5 presents an overview of the main data sets used for

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<sup>4</sup> Source: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/648165/HEIP\\_R\\_PUBLICATION\\_2015-16.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/648165/HEIP_R_PUBLICATION_2015-16.pdf), Chart 2

the analysis. Section 6 reports and discusses the findings from the estimated nested logit model and comparison with the multinomial logit model. Section 7 presents a summary and conclusion to the paper.

## **2. Schooling in England**

In England, the end of compulsory schooling is at age 16. At this age, most youths take qualifications called General Certificates of Secondary Education (GCSEs). These are subject based national examinations and there is an expectation that students who wish to remain in the education system beyond age 16 would achieve more than five of these examinations at grades A\*-C<sup>5</sup>. The average test score achieved at GCSE is certainly a reasonable indicator of which students are likely to remain in the education system and go on to university. Those who intend to leave school at age 16 unsurprisingly take fewer of these qualifications and achieve lower grades. Generally, those with the lowest achievement at GCSE end up not in employment, education or training (NEET). Hence, at age 16 there is a clear decision about whether to continue or not in education and training, and this decision will be heavily influenced by the youth's achievement in their GCSEs.

Students on the academic path stay in full time education to age 18, taking Advanced Level (A level) examinations, normally in three or four subject areas. These academically oriented students are then highly likely to proceed on into university. Those students who are not on the academic path either try to enter the world of work immediately after the end of compulsory schooling or continue in full or part time education, taking a vocational qualification. The proportion remaining in full time education beyond the end of compulsory schooling has risen over time and indeed between 2004 and 2011, individuals who came from low income families (on state benefits) and who stayed on in full time education received an allowance to do so (the Education Maintenance Allowance or EMA). The authors own calculations from the Longitudinal Study of Young People in England suggest that 72% of the cohort remains in full time education in the year after the end of compulsory schooling; of the remaining 28%, approximately two thirds enter the labour market and the other third are not in education, employment or training (NEET). The path into work is was a particularly difficult one, given economic conditions in England at this time. Youth unemployment rates hit a 15 year high with over one in five economically active 16-24 year olds being out of

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<sup>5</sup> These examinations are graded A\*, A, B, C, D, E, F, G and U (fail).

work (in July-September 2011). However, those who were successful in securing employment had wage protection via the national minimum wage for youth, which was introduced in 2004. An important path at age 16-19 is work based training and a significant minority of students (approximately 6% of the LSYPE cohort) enrol on apprenticeship programmes at age 16-19. These apprenticeships have high value in the labour market (McIntosh, 2006).

Note that a particular characteristic of the English education and training system is that a significant proportion of young people remains in full time education beyond the end of compulsory schooling, only to drop out again relatively rapidly. For example, LSYPE data indicates that by age 17/18 only just over half the cohort remains in full time education one year after the end of compulsory schooling.<sup>6</sup> By age 18/19 only around 44% of the cohort remains in full time education (30% in higher education).

Legislation has now been introduced in England to encourage students to remain in education still longer (the Raising of the Participation Age or RPA)<sup>7</sup>. The RPA legislation (as outlined in the Education and Schools Act 2008) sets out that all young people in England had to continue in some kind of education or training to age 17 from 2013 and to age 18 from 2015, though this does not necessarily mean staying in full time education.

### **3. Theoretical Framework and the related literature**

The analysis of individuals' decisions on whether or not to participate 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

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<sup>6</sup> These data may overstate the numbers leaving full time education at this age, as some individuals who are interviewed in the summer (around 20%) may record that they are not in full time education even if they intend to continue in full time education in the autumn. Some may also not be sure if they are able to continue in full time education and will be waiting for their examination grades.

<sup>7</sup> For the period covered by the LSYPE data that we have, students had only to remain in compulsory schooling up to the age of 16.

for studying<sup>8</sup>, 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.

The unemployment rate may have an ambiguous effect on individuals' demand for education (see Kodde, 1988; Taylor and Rampino, 2014). Theoretically, 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, thus inducing students to stay more in education. This is the so called *discouraged worker effect*, whereby young people withdraw from the labour market in the face of high unemployment. Moreover, an increase in unemployment which affects those at the bottom of the education distribution to a greater extent, will provide an incentive to accumulate the skills necessary to succeed in a weak labour market. This mechanism would lead to an increase the demand for education, which is an enhancing factor for future employability (the so called "*insurance effect*", see Tumino and Taylor, 2015). However, students have incomplete information (see, for example, See, for example, Jensen, 2010, who shows that people make decisions about education based on what they perceive to be the returns to education, and these perceptions may be inaccurate). Hence, high adult unemployment and a generally weak labour market may increase the perceived value of securing a job now (for fear of failing to do so later) and hence youths may drop out of school if presented with a job opportunity. A weak labour market may also be interpreted by youths as indicating a reduction in the likelihood of finding work in the future and hence reducing the return to their education. This is likely to be a misinterpretation of the labour market since even with high adult unemployment it is generally the case that unemployment affects the low skilled to a greater degree and hence the return to post-school education may remain relatively high. However, with poor information, high adult unemployment or low average wages may reduce the probability of staying on at school after the compulsory leaving age ("*discouraged student effect*") (see Micklewright *et al.*, 1990, Petrongolo and San Segundo, 2002).

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

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<sup>8</sup> Education may have consumption value for some students who enjoy learning.

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. Tumino and Taylor (2015), using data from the British Household Panel Survey (BHPS), found that an increase in the local youth unemployment rate positively affects school enrolment after 16, especially for young people from lower socio-economic background that are more sensitive to prevailing labour market conditions. Similarly, Taylor and Rampino (2014), again using BHPS data, showed that educational aspirations and attitudes of young people are counter-cyclical, in the sense that they view participating in post-compulsory schooling more positively when unemployment is relatively high. These last findings are consistent with the opportunity cost and discouraged worker arguments, according to which, a weak youth labour market increases participation in post-compulsory education. In contrast, Pastore (2014), using data from the Polish labour force survey, finds that in high unemployment areas, young people prefer to seek a job rather than study. Moreover, his results show that economic factors play a larger role in educational choices of males than females. Similarly, Alam and Mamun (2016), using Australian data, find that high unemployment causes a significant reduction in the benefit of education, thus reducing the probability of staying in school.

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<sup>9</sup>. However, a number of studies in the U.S have found negative effects of the minimum wage on teenage school enrolment (Neumark and Wascher, 1995, 2003; Chaplin *et al.* 2003).

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, and 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 more recent study 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 on the fact 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. 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 youths invest in post compulsory education in other countries (see for

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<sup>9</sup> Their idea is that for all youths 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.

example Petrongolo and San Segundo, 2002 for Spain; Kane, 1994 for the United States; and Kodde and Ritzen, 1985 for the Netherlands). Much of the literature has not explored differences in these patterns by gender.

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, most of the studies of this issue have assumed that determinants of schooling decisions are similar for males and females. However, with growing disparities in the education achievement of males and females<sup>10</sup> and given the gender-patterned choices of both curriculum and occupation, it is likely that labour market conditions impact differently on males and females. Understanding the distinct role of school achievement and local labour market conditions on the decisions made by males and females is therefore a key gap in the literature that we address.

Secondly, the above studies 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 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)<sup>11</sup>. The LSYPE also have an extremely comprehensive set of family background and other controls for our model, including youth 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 a youth 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

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<sup>10</sup> Recent evidence shows that women outperform men in educational attainment in most Western countries (see for example Van Hek *et al.*, 2016)

<sup>11</sup> The Key Stage tests are national achievement tests performed by all children in state schools. The tests are anonymised and marked by external graders.

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<sup>12</sup>. 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 as explained below. We therefore add to the literature by estimating instead a nested logit which allows for potential sequencing in the decision-making process (though does not require it) and relaxes the strong IIA assumption. Our application of this model and its advantages are described below.

#### **4. Modelling framework**

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 youths 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 is particularly problematic in this case. One reason for this is that individuals' decisions about whether to stay on in schooling or pursue a job are both clearly related to their prior academic achievement. Youth will be considering, and teachers and parents will be advising, different options on the basis of the relative feasibility of each

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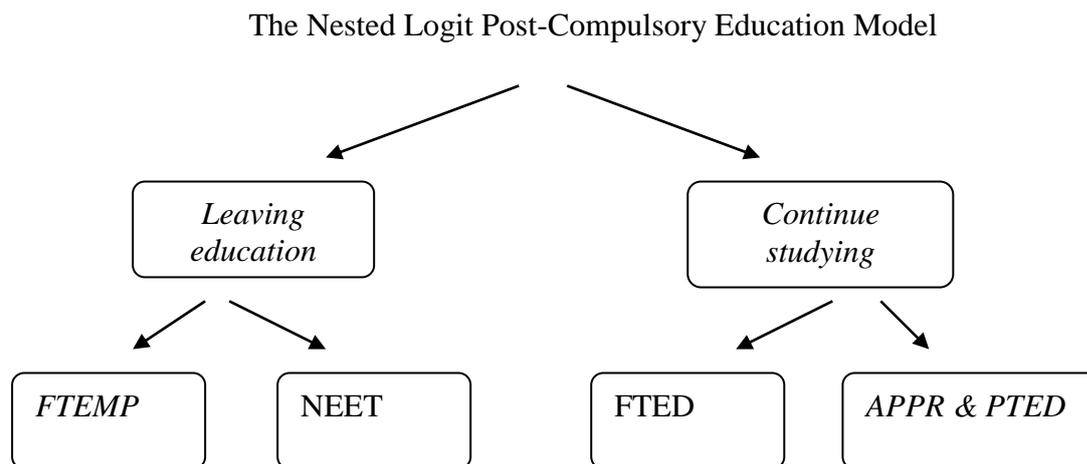
<sup>12</sup> They distinguish between: staying on and studying for academic qualifications; staying on and studying for vocational qualifications; leaving to employment associated with on the job training; leaving to employment associated with general skills training; leaving for general skills training; and unemployed.

option. For example, a decision about whether the youth should pursue a job would be impacted if say another alternative, such as part time apprenticeship study, is presented. In this way, the alternatives facing the student are not independent of one another. The options 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 potentially structured and sequential decision-making process youths engage with in relation to the post-compulsory schooling decision. The four post-compulsory education alternative outcomes that youths at age 16 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 model decision tree structure is constructed as the following:



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. Youths first 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 youth decides to leave education, s/he then faces the alternatives of working full-time or being unemployed / out of the labour force and without training. The potential for this structured and sequential decision process with the nested logit is attractive from a modelling point of view as it could be argued that students do indeed make a sequential decision in this manner. As discussed in Section 2, the options that students at age 16 choose will be strongly determined by their success in school and specifically their GCSE examinations. Success in these examinations enables a student to stay on in full time education or training beyond age 16 and enrol in their school or a separate 6<sup>th</sup> form or further education college. What they choose to study post 16 may vary according to a wide range of factors, including interests and inclinations. Hence the first stage of the decision process is for the student to determine, on the basis of their achievement at age 16 and other factors, whether to stay on in education and training or not. Then having made that decision, if the student decides to remain in education and training they will need to determine which of the two basic options open to them will they follow: full time education (including the university route) or taking the part time education or training route. The latter part time option enables the student to secure employment either separately from the qualification they are studying for or as part of their training (e.g. an apprenticeship). For those who decide to leave education after the end of compulsory schooling at age of 16, there are also several options, namely they can enter the world of work immediately or, failing that, they can end up being NEET.<sup>13</sup>

On grounds of specification, we use the nested logit to group similar choices and selectively relax the IIA assumption. The nested logit does not require a sequential decision-making process to be imposed and more flexibly only requires the grouping of error terms to allow the IIA to hold within (but not across) groups (or limbs).

#### ***4.1: Model specification***

This decision process faced by individual youths can be presented within the random utility model (RUM) framework whereby the individual will choose from one of the four unordered

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<sup>13</sup>The specification of the nested logit model was motivated by educational theory: however it is interesting to note that the presented specification is also preferred on the basis of comparisons of information criteria (AIC) and log-likelihood statistics to two alternative specifications of the nested logit model where (1) 'Appr & PTED' is combined as an additional branch into the 'leaving education' limb or (2) where 'FTEMP' is combined as an additional branch into the 'continuing to study' limb which might then be considered as the 'human capital accumulation' limb (where FTEMP represent labour market experience acquisition).

outcomes - FTED, FTEMP, APPR & PTED or NEET - depending upon whichever provides the highest returns for the individual youth. Formally, and following the exposition and notation in Cameron and Trivedi (2005), 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 youth subscript  $i$  suppressed:

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

Where the utilities are split into a deterministic and stochastic component and the deterministic component is defined as:

$$V_{jk} = \mathbf{x}' \boldsymbol{\beta}_{jk} + \mathbf{w}'_{jk} \boldsymbol{\varphi}_{jk}$$

and  $\boldsymbol{\beta}_{jk}$  and  $\boldsymbol{\varphi}_{jk}$  vary over limbs and branches. The regressors contained within the vector  $\mathbf{x}$  are all case or individual-specific variables. These variables describe the characteristics of the decision maker, the individual youth. In comparison the  $\mathbf{w}_{jk}$  variable represents an alternative-specific variable that presents variation over the four alternative outcomes that the individual can choose and hence both case and alternative specific. Since the variation over alternatives provides (for each decision maker) additional grounds for identification, a separate parameter for each alternative is statistically identified.<sup>14</sup> An example of a  $\mathbf{w}_{jk}$  variable is the average expected return that each  $m$ -choice of outcome would provide to the individual given their attainment (or ability). Inclusion of both the individual-specific and alternative-specific variables provides a ‘mixed’ structure for the model.

Further  $\mathbf{w}_{jk}$  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

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<sup>14</sup> It should be noted that the coefficient attached to the  $\mathbf{w}_{jk}$  alternative-specific variable can be restricted to have a joint coefficient for all post-compulsory schooling activity (a ‘generic’ variable) with the interpretation of ‘expected wage return’ in terms of utility, however we do not impose this restriction and instead estimate the four identified coefficients.

whether expected (wage) returns impact significantly on the choice of post-compulsory schooling activity (and indeed on which of the activities). Section 5 contains a discussion of how this variable was constructed using data from the 1970 British Cohort Study and the individual youth'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 (see Manski, 1993, for an excellent discussion of this issue).

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:

$$P_{jk} = P_j \times P_{k|j} = \frac{\exp(\rho_j I_j)}{\sum_{m=1}^J \exp(\rho_m I_m)} \times \frac{\exp((\mathbf{x}' \beta_{jk} + \mathbf{w}'_{jk} \varphi_{jk}) / \rho_j)}{\sum_{l=1}^M \exp((\mathbf{x}' \beta_{jl} + \mathbf{w}'_{jl} \varphi_{jl}) / \rho_j)}$$

where  $\rho_j$  is a function of the correlation between  $\varepsilon_{jk}$  and  $\varepsilon_{jl}$ , and

$$I_j = \ln \left( \sum_{l=1}^{K_j} \exp((\mathbf{x}' \beta_{jl} + \mathbf{w}'_{jl} \varphi_{jl}) / \rho_j) \right) \text{ is called the inclusive value or the log-sum.}$$

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  $\beta_{jk}$ ,  $\varphi_{jk}$  and  $\rho_j$ .

#### 4.2. Causality

We have already stressed the advantages of using the nested logit in our estimation. However, we acknowledge that our model does not necessarily enable us to identify a causal

relationship between our variables of interest, namely local area labour market variables, and the likelihood of the young person choosing a particular transition at age 16. Specifically, the model may still suffer from omitted variable bias. It may be that the local labour market variables we include are correlated with unobserved factors that are specific to the individual (or to the area in which they live) that affect their participation decisions. Under these circumstances, any relationship between labour market conditions and participation decisions that we identify may be considered spurious.

Ideally, we would identify exogenous changes in local labour market conditions in some areas but not others to identify causal impact. For instance, if there was a policy experiment in which the minimum wage for young people was raised in some areas and not in others, we could then identify the impact of exogenous changes in local wages on young people's participation decisions. Unfortunately, we have not been able to identify such exogenous variation. We therefore rely on the richness of our data to allow for factors that influence the decisions that youth make. The literature (Micklewright, 1990; Clark *et al.*, 2005; Dearden *et al.*, 2009) would suggest that comprehensive and high-quality measures of the child's prior achievement are the most important drivers of participation decisions and proxy a number of unobserved individual characteristics (such as persistence, attitudes to school etc). As has already been stated, we have very good measures of prior achievement in our data, as well as rich data on other important determinants, such as attitudes. We therefore simply note that our estimates may still be subject to bias from unobserved variable bias.

## **5. Data**

The LSYPE is a representative sampled survey of about 15,000 young people in England, aged 13 and 14 in 2003/2004 (born between 1.9.89 and 31.8.90) 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.<sup>15</sup>

We matched LSYPE data to National Pupil Database and Pupil Level Annual School Census (NPD/PLASC) using pupil and school unique identifiers provided in both dataset. This gives

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<sup>15</sup> Formally, the end of compulsory schooling in England is the last Friday in June after the youth reaches the age of 16.

us information on youths' scores in standard national tests (key stage tests), i.e. a historical record of youths' 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, 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 2<sup>nd</sup> largest destination group after full-time education. The table also highlights that the distribution of main activity at age 16 varies substantially by gender, as well as by family background and prior educational attainment (see columns 2-7 of Table 1).

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<sup>16</sup> unemployment rate, from the Labour Force Survey.<sup>17</sup> 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 indicate a weak labour market, which may cause young people to prioritise getting a job. 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 includes 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

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<sup>16</sup> 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 responsible for local services, such as education.

<sup>17</sup> Further tests for sensitivity of estimates to different geographical aggregation on the unemployment and wages variables are illustrated (for males) in table A.3.

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. We created a measure of the expected gain from choosing each of the four 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<sup>18</sup>) and making the same choice at age 16.

We include in our model measures of youths' prior 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 youths 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. We use a capped average point score<sup>19</sup>

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<sup>18</sup> The age 16 sweep of BCS was conducted during a teacher strike and hence there are extensive missing data for that sweep. We therefore make use of the age 10 test scores instead.

<sup>19</sup> 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

that takes into account the youth'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 youths' 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 have a different willingness or ability to subsidise costs during post compulsory education. LSYPE data does not include a high-quality measure of parental income. Therefore, we use youths' eligibility for Free School Meals (FSM) to proxy family poverty status (Hobbs and Vignoles, 2007) and parental occupation<sup>20</sup> as an indicator of parental income. Parental education may also be a key factor affecting schooling decisions, 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 youths, some of which are likely to affect the post compulsory schooling decision. Among these attitude variables, we use a variable describing youths' 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<sup>21</sup>. 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 youth to stay on in full time education, which was asked when the youth was in

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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.

<sup>20</sup> 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.

<sup>21</sup> 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 youths 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](http://www.data-archive.ac.uk/doc/5545/mrdoc/pdf/5545wave_three_documentation.pdf)

Year 9. Including these attitudinal variables is intended to account for what would otherwise be unobserved youth heterogeneity that might be correlated with staying on.

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. This variable, as is the case for other attitudinal variables, may of course be proxying unobserved aspects the family circumstances or the characteristics of the youth.

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. 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 youths in the school staying on beyond the school leaving age. Only the proportion of youths 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 note however, that this variable may be a proxy measure of other omitted aspects of school quality or indeed the composition of the student body.

Lastly, we control for regional differences in labour market opportunities and industrial structure by including regional dummy variables.

Table A1 in the Appendix provides summary statistics for all the variables included in our analysis.

## **6. Results**

For comparison purposes, we present our results using a range of models.<sup>22</sup> 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 effects are shown for both males and females separately and with standard errors robust to both heteroskedasticity and local authority clustering. We model males and females separately since educational achievement trajectories vary by gender and the impact of labour market conditions on the staying on decision may also differ due to different occupational choices made by males and females (see for example Bertrand, 2011, who provides evidence regarding gender differences in risk preferences, in attitudes towards competition, and in attitudes towards negotiation). The following factors affect the schooling decisions of both males and females: educational attainment at GCSE, whether the 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 local labour market conditions are an important driver of post 16 participation decisions and how this varies by gender, 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 youth unemployment and wage rates on the leave/stay decision for males and females, suggesting (at least in this simple binary decision model) that local labour market conditions do not affect the decision to remain in school.<sup>23</sup>

Tables 3 and 4 extend the model to incorporate the four choices (full-time education, apprenticeship and part-time education, full-time employment or NEET). The incorporation of the four distinct outcomes into the modelling framework is both theoretically and empirically appealing as the choice set facing individuals is more complex than a simple binary choice. Presented estimates support the earlier finding that educational attainment at GCSE, and positive parental and youth attitudes 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. Unlike in the previous results, the impact of the youth local unemployment rate is statistically significant

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<sup>22</sup> It should be noted that the maximum LSYPE sample reduced from 15,000 to 6,333 due to sample attrition and missing data on some key variables, including the dependent variable.

<sup>23</sup> Tables A.2 and A.3 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 youth attitude to school are seen to significantly determine the choice of full-time education over other options.

for males (Table 4). For males, higher local unemployment rates reduce the probability of youths 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. For females the direction of effect is the opposite (relative risk ratio in excess of one) though insignificant.

Tables 5 and 6 present the results from our preferred nested logit model for females (Table 5) and males (Table 6). 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 implies that the likelihood of taking any one of the options is not independent of decision about taking another, the choices are inter-related. This result, along with the formal tests of the IIA assumption reported for the MNL models (Tables 3 and 4), provides evidence to support our alternative modelling approach of using the nested logit. In 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. Table 7 reports the marginal probabilities of choosing a particular post-compulsory choice associated with an increase in each covariate.

As previously noted, the nested logit model allows identification of an alternative-specific variable - a variable which varies across the four different outcome options. In our model this variable measures the expected returns (wages) the individual can expect from each of the four different alternative options (see Section 5). Variation in this variable is observed both within and across individuals since the expected returns from each of the four different labour market options will vary by the young person's ability. The coefficient on this variable for each of the outcomes is shown in the first row at the top of Tables 5 and 6. These estimates show that as the return to each activity increases, youths are more likely to choose the relevant option (full-time education, apprenticeships or full-time employment). The estimated effects are positive and significant for full-time education and full-time employment for females and for full-time education and apprenticeship for males. For both females and males the estimated coefficient for NEET is insignificant – suggesting that the (negative) return to this activity does not affect the likelihood of being NEET. There are gender differences in the magnitude of the effects. The impact of the expected return to full-time education is greater for males, consistent with males placing a higher emphasis on the rate of return to education when selecting post-compulsory education activities than females. It is also of interest to note

that females appear more responsive to the expected returns to the full-time employment choice at age 16 than males. These results imply that males are more sensitive to the expected gains from investing in education, perhaps related to their (on average) greater attachment to the labour market throughout their lives. Female choices appear more heavily determined by the value of entering work early.

Further estimates in Table 5 for females and Table 6 for males show that prior achievement is negatively 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 (for apprenticeship/part-time work) 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, as well as the student's own attitude to school. For males only, low parental income (as proxied by whether the student was eligible for Free School Meals at secondary school<sup>24</sup>) is positively associated with being NEET, even after controlling for the student's GCSE achievement.

We also found that females who have English as an additional language are significantly 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 women from families where English is an additional language or, more negatively, is a barrier that makes it more difficult for such women 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 (and significantly so for apprenticeship/part-time work and full-time employment). 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 only significant for

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<sup>24</sup> LSYPE data does not include a high-quality measure of parental income (banded). However, as a robustness check, we try to include this alternative measure and our main results are not affected.

apprenticeship/part-time work. 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). It is also possible that the school type variables are proxying other characteristics of the area or the student and hence are not causal.

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.<sup>25</sup> 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 (though insignificant) 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. Again, the number of hours of work may also be a proxy for other family background characteristics we do not observe.

Our main variables of interest are the local youth unemployment rate and the local youth wage rate and here the results for males and females differ markedly. For females (Table 5) there is weak evidence that 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. We also find that females in areas with higher unemployment rates for youths have a lower probability of being NEET relative to being in full time education. This is consistent with predictions that difficult labour market conditions may lead women into the labour market if they are successful in securing a job, but equally may encourage those who cannot get a job to remain in full time education as a better alternative to becoming NEET. It should be noted though that these results are not statistically significant.

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<sup>25</sup> We argue that by including this rich source of individual level data we make a serious attempt to control for the ability and motivational factors that will impact on decisions to invest in human capital (see Eckstein and Wolpin (1999) for a useful discussion of the importance of these variables). Although we cannot claim that all possible unobserved heterogeneity has been controlled for, we would argue that to focus further on this specific point and to handle any distorting effects of unobserved heterogeneity lies in explicitly controlling for these factors and modelling the initial condition, a distinct modelling approach to the one taken here, for example the dynamic mixture model.

Further, the local wage rates are also not significantly correlated with labour market choices for females. 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 reveal support for the view that for females, high wages and good labour market conditions tend to encourage further investment in full time education, which suggests that females are valuing future returns more than current ones, consistently with the evidence showing that females have lower time preferences and tend to be more patient than males (see Dittrich and Leipold, 2014)

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 higher probability of being NEET, suggesting that in difficult labour market conditions males who do leave full-time education then struggle to find work. For males, higher wages are also negatively associated with being in full time and apprenticeship/part-time employment but are again insignificant.<sup>26</sup>

Table 7 reports the marginal probabilities for the nested logits presented in Tables 5 and 6. The marginal probabilities show clearly the greater importance of factors such as the longer-run wage returns (by age 30) to each post-compulsory choice, parental aspirations, youth attainment and parental educational background, as compared 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 youths 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 youths’ 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 youth (e.g. greater careers advice, support and aspiration coaching).

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<sup>26</sup> 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.

Overall then the patterns of results from nested logit model suggest the clear importance of the expected wage returns to the post-compulsory choice, along with (as also did the MNL) the youth attainment through GCSE scores, parental aspirations and youth attitudes to school (particularly for males), as the primary drivers of the post-compulsory education choice, for both males and females. However, for males local labour market conditions are also an important factor driving decisions, with weak labour market conditions encouraging greater levels of human capital investment.

## **7. Robustness checks**

As a robustness check, we explored a number of possible interactions, starting with interactions between local labour market conditions and the youth's prior achievement as reported in Table 8.<sup>27</sup> We wanted to determine whether labour market conditions impact different types of youths heterogeneously, with lower achieving youths being more influenced by labour market conditions. To do this we 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. Neither for females or males did the inclusion of the interaction terms alter the findings described above (as in Table 5 and 6). Although these results are clearly consistent with local labour market conditions not impacting heterogeneously across the youth population based on ability/attainment we should remember that the behaviour we observe in our data may have been influenced by EMA and that going forward, young people may well be more sensitive to labour market conditions and that this could impact heterogeneously across the youth population.

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 including exploring the sensitivity of results to different definitions of the local labour market variables,

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<sup>27</sup> 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).

aggregating to regional rather than local authority level and changing the age range for the wage variables. Broadly, for females and males the labour market variables remain insignificant regardless of data aggregation and definition (see Appendix Table A3).

## **8. Concluding remarks**

This paper assesses the role of local labour market conditions (specifically, relative unemployment and wage rates) in determining post-compulsory schooling decisions, with a focus on how males and females respond differently to labour market signals. We use the Longitudinal Study of Young People in England (LSYPE), a rich socioeconomic data set which combines individual-level attainment and school-based administrative (National Pupil Database, the Pupil Level Annual School Census and the LEA and School Information Service), combined with local labour market data (Annual Survey of Hours and Earnings and Annual Population Survey). We contribute to the literature substantively by providing recent empirical evidence from the UK and methodologically, using a nested logit which relaxes the IIA assumption across branches to model the post-compulsory education decision. Although our evidence is not experimental, rich high-quality data and an appropriate methodological approach ensures that we have results that are highly informative from a policy perspective.

Our findings are important in two respects. Substantively, we show that the primary drivers of the post-compulsory schooling decision for both males and females are the expected wage return to the options available to each student, their prior educational attainment, their attitude to school and parental aspirations. This is consistent with previous literature, which has generally shown a strong impact from prior education achievement on the post-compulsory schooling decision. However, only males appear significantly sensitive to labour market conditions, namely unemployment rates. Previous work reviewed above has produced rather mixed evidence in terms of the relationship between youth unemployment rates and the post-compulsory schooling decision. Methodologically, we found that the framework chosen for modelling the decisions taken at age 16 is important and likely to impact substantively on empirical findings. For example, simple binary models of the school leaving decision suggested that local labour market conditions were not significant drivers of youths' choices in the UK. However, using modelling approaches that allow for multiple unordered outcomes (such as the MNL and nested logit) indicated that local labour market conditions (particularly unemployment) do in fact impact on choices and crucially, that they do so differently for males and females.

The nested logit also has the major advantage that it allows us to model whether the likely wage returns to each option influence individuals' decisions. Specifically, we model the relationship between an individual specific estimate of the return to each of the four choices, and the likelihood of an individual taking a particular choice. This variable is a significant predictor and for males, the return to taking the full-time education option is relatively large, suggesting male decisions about participation in schooling are more strongly driven by their expected labour market gains as compared to females. This is an important contribution to the literature as previous work has by and large not modelled the expected returns for each individual. Instead, studies have assessed the impact of wage changes on schooling behaviour, for example after the introduction of the minimum wage in the UK, and found rather modest impacts. Given the importance of returns to education as drivers of education choices, it is crucial that young people are provided with accurate information about labour market outcomes of different options, in order to avoid that erroneous perceptions on returns lead people to under-invest in education (see Jensen, 2010). Further, this has clear policy implications in identifying strategies to improve, or complete the information set available to young people so that they do recognise the optimal path as being to invest in post-schooling education.

Our results certainly highlight gender differences in factors affecting schooling decisions. For example, for males we found that higher unemployment rates keep males in full time education whereas there is little impact from local wage rates. For females there was only weak statistical evidence of a relationship between unemployment and participation in post compulsory schooling and higher unemployment appears to, if anything, draw them into the labour market. Using data from the 1950s and 1960s, Pissarides (1981) also found that males were more responsive to local labour market conditions, particularly unemployment, and that females were less so. Hence despite radical changes in female labour market participation and indeed a dramatic increase in female participation in post compulsory schooling in the intervening period, our evidence suggests that males remain more responsive to the labour market than females in terms of this early schooling decision. This is consistent with the occupational and career investment choices made by young people remaining highly gender patterned. Females for example, on average have different attitudes to risk, which may reduce their sensitivity to what might be short run variations in unemployment or wages (Betrand, 2011). It is of course also conceivable that females may base their schooling decision on

other factors that are not captured in our data, again consistent with some of the other psychological factors reviewed by Bertrand, including notions of social norms. For example, Vella (1994) shows that females' attitudes towards traditional gender roles significantly affect their human capital investment, labour supply and rates of return to education. In the same vein, Casarico, Profeta and Pronzato (2016) using EUSILC suggest female decisions to enrol in tertiary education are impacted by female specific factors, such as the share of women with managerial positions. Similarly, van Van Hek *et al.* (2006) show that higher level of female labour market participation improves women's performance in education, suggesting that economically active women may function as role models encouraging young girls to pursue an educational and professional career, whereas high levels of religiosity during that phase negatively affect women's educational attainment. This may suggest avenues for future research investigating female specific factors that drive schooling decisions.

These findings are also salient for policy changes occurring during this period in the UK. 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 counter balanced by the 'push' toward post-compulsory schooling caused by the rise in youth unemployment during the late noughties recession. Our work also spanned a period during which young people from families with lower family income received a conditional cash transfer to stay on in full-time education (the Education Maintenance Allowance). It was subsequently abolished (in 2011). Our research might suggest that since the abolition of the EMA happened in a difficult economic climate (in terms of high unemployment), for males at least, this difficult labour market is likely to have encouraged greater levels of post compulsory participation in education, working in the opposite direction to the impact of abolishing EMA<sup>28</sup>.

In summary therefore, our work suggests that young males are more sensitive to local labour market conditions. However, for both males and females, the main drivers of the post-

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<sup>28</sup> Note that in 2013 the legal age for participating in education was raised to age 18 and hence non participation was not an option from that time onwards.

compulsory schooling decision at age 16 are expected returns by educational attainment, and the aspirations and expectations of and for the child.

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**Table 1****Economic activity status at age 16/17, (LSYPE)****Table 1: Distribution of Economic Activities at age 16/17 (column %) (LSYPE)**

	Full sample	By gender		By parents' education		By past educational attainment	
		<i>Female</i>	<i>Male</i>	<i>Father has degree</i>	<i>Father has no degree</i>	<i>5-GCSE A*-C</i>	<i>Less than 5-GCSE A*-C</i>
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

**Note:** The table reports the distribution (column %) of economic activities of young people at age 16/17 after the end of compulsory education. The first column shows the distribution for the whole sample, while in columns 2-7 we divide the sample according to gender (col. 2,3), parents' education (col. 4, 5) and past educational attainment, as proxied by an indicator for whether the youth has achieved more than five GCSE at grades A\*-C (top grades).

**Table 2****Probability of leaving education at the end of compulsory period at age 16/17**

Logit	Coefficient estimate	Average marginal effect	
		Female	Male
Key stage 4 (GCSE) standardised score	-0.843 (0.108)***	-0.070	-0.080
Mother has degree	-0.913 (0.441)**	-0.076	-0.024
Father has degree	-0.601 (0.303)**	-0.050	-0.080
Log(local unemployment rate age 16-19)	-0.136 (0.176)	-0.011	-0.008
Log (local average wages - age 16-21)	-1.115 (1.083)	-0.092	-0.103
Whether parent wants student to stay at school	-0.525 (0.173)***	-0.044	-0.051
Whether has 5 GCSEs at A*-C	-0.858 (0.207)***	-0.071	-0.070
Attitude to school (scale)	-0.042 (0.010)***	-0.003	-0.005
Free school meals	-0.102 (0.250)	-0.008	0.017
Whether English as additional language	-0.300 (0.333)	-0.025	-0.141
School % of youths staying in FTED	-0.015 (0.008)*	-0.001	-0.002
Number of hours worked during school term	0.055 (0.016)***	0.005	0.003
<b>Regional dummies</b>	<b>yes</b>		<b>Yes</b>
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
Log(local unemployment rate age 16-19)	1.123 (0.266)	1.383 (0.318)	0.650 (0.153)*
Log (local average wages - age 16-21)	15.768 (33.76)	0.830 (1.569)	0.334 (0.485)
Key stage 4 (GCSE) standardised score	0.581 (0.120)***	0.388 (0.060)***	0.388 (0.056)***
Mother has degree	0.935 (0.359)	0.497 (0.269)	0.314 (0.195)*
Father has degree	0.530 (0.210)	0.479 (0.209)*	0.571 (0.214)
Whether has 5 GCSEs at A*-C	0.307 (0.091)***	0.480 (0.122)***	0.369 (0.103)***
Whether parent wants student to stay at school	0.500 (0.097)***	0.526 (0.112)***	0.523 (0.127)***
Attitude to school (scale)	0.955 (0.013)***	0.957 (0.014)***	0.948 (0.009)***
Free school meals	0.985 (0.283)	0.785 (0.316)	0.938 (0.258)
Whether English as additional language	0.918 (0.419)	0.381 (0.233)	0.940 (0.334)
School % of youths staying in FTED	0.993 (0.010)	0.991 (0.011)	0.980 (0.010)**
Number of hours worked during school term	1.049 (0.026)**	1.097 (0.022)***	1.032 (0.024)
<b>Regional dummies</b>	<b>yes</b>	<b>yes</b>	<b>yes</b>
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	<b>APPR &amp; PTED</b>	<b>FTEMP</b>	<b>NEET</b>
Log(local unemployment rate age 16-19)	0.852 (0.189)	0.633 (0.098)***	1.311 (0.285)
Log (local average wages - age 16-21)	0.647 (1.032)	0.155 (0.258)	0.706 (1.008)
Key stage 4 (GCSE) standardised score	0.734 (0.103)**	0.388 (0.058)***	0.460 (0.057)***
Mother has degree	0.575 (0.184)	0.543 (0.177)*	0.961 (0.328)
Father has degree	0.543 (0.156)**	0.379 (0.157)**	0.507 (0.179)*
Whether has 5 GCSEs at A*-C	0.349 (0.067)***	0.556 (0.119)***	0.380 (0.081)***
Whether parent wants student to stay at school	0.367 (0.059)***	0.403 (0.069)***	0.559 (0.087)***
Attitude to school (scale)	0.953 (0.008)***	0.947 (0.009)***	0.941 (0.009)***
Free school meals	1.056 (2.94)	0.601 (0.256)	1.567 (0.347)**
Whether English as additional language	1.079 (0.387)	0.113 (0.088)***	0.310 (0.085)***
School % of youths staying in FTED	0.983 (0.007)**	0.977 (0.009)***	0.984 (0.008)**
Number of hours worked during school term	1.040 (0.018)**	1.075 (0.016)***	0.986 (0.024)
<b>Regional dummies</b>	<b>yes</b>	<b>yes</b>	<b>yes</b>
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)**

	<b>FTED</b>	<b>APPR &amp; PTED</b>	<b>FTEMP</b>	<b>NEET</b>
Expected returns to post-compulsory activity	5.860 (2.655)**	6.022 (5.177)	15.629 (5.278)***	-1.088 (1.829)
Log (local unemployment rate age 16-19)		0.323 (0.500)	3.486 (2.560)	-2.698* (1.650)
Log (local average wages - age 16-21)		3.038 (4.137)	-14.420 (15.769)	9.707 (10.587)
Key stage 4 (GCSE) standardised score		-0.374 (0.984)	1.167 (1.760)	-0.690 (1.067)
Mother has degree		-0.018 (0.542)	1.162 (3.313)	-2.697 (2.999)
Father has degree		-0.850 (1.207)	0.932 (2.776)	-1.769 (2.204)
Whether has 5 GCSEs at A*-C		-1.960 (2.359)***	-0.245 (2.459)	-1.231 (1.708)
Whether parent wants student to stay at school		-0.959 (0.975)	-3.039 (2.854)	0.863 (1.828)
Attitude to school (scale)		-0.063 (0.066)	1.503 (2.666)	0.001 (0.061)
Free school meals		0.002 (0.390)	1.503 (2.666)	-1.194 (1.688)
Whether English as additional language		-0.057 (0.622)	-8.776 (3.213)***	5.456 (2.365)**
School % of youths staying in FTED		-0.008 (0.015)*	-0.080 (0.108)	-0.032 (0.074)
Number of hours worked during school term		0.075 (0.100)**	0.703 (0.431)*	-0.443 (0.279)
<b>Regional dummies</b>		<b>yes</b>	<b>yes</b>	<b>yes</b>
Observations	12,448	12,448	12,448	12,448
	3,112	3,112	3,112	3,112
LR test for IIA	29.59***	29.59***	29.59***	29.59***
log likelihood	-1513	-1513	-1513	-1513
Wald test	1682.47***	1682.47***	1682.47***	1682.47***

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
4. Control vector excludes house prices due to non-convergence.

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

	<b>FTED</b>	<b>APPR &amp; PTED</b>	<b>FTEMP</b>	<b>NEET</b>
Expected returns to post-compulsory activity	6.991 (2.421)***	6.727 (2.186)***	3.141 (2.982)	-1.096 (2.114)
Log (local unemployment rate age 16-19)		-0.492 (0.531)	-0.948 (0.465)**	0.611 (0.501)
Log (local average wages - age 16-21)		-2.353 (3.856)	-4.360 (3.917)	1.064 (3.060)
Key stage 4 (GCSE) standardised score		-0.196 (0.544)	-0.684 (0.504)	0.058 (0.316)
Mother has degree		-1.027 (0.792)	-1.210 (0.107)*	0.371 (0.785)
Father has degree		-1.388 (0.928)	-1.019 (0.827)	-0.684 (0.647)
Whether has 5 GCSEs at A*-C		-2.782 (1.049)***	-0.430 (0.432)	-1.224 (0.468)***
Whether parent wants student to stay at school		-2.190 (0.700)***	-1.375 (0.362)***	-0.623 (0.366)*
Attitude to school (scale)		-0.103 (0.033)***	-0.065 (0.018)***	-0.080 (0.016)***
Free school meals		0.014 (0.613)	-1.244 (1.212)	0.786 (0.481)*
Whether English as additional language		0.335 (0.821)	-3.846 (2.515)	-0.696 (0.714)
School % of youths staying in FTED		-0.029 (0.016)*	-0.027 (0.015)*	-0.014 (0.013)
Number of hours worked during school term		0.084 (0.036)**	0.131 (0.061)**	-0.069 (0.083)
<b>Regional dummies</b>		<b>yes</b>	<b>yes</b>	<b>Yes</b>
Observations	12,884	12,884	12,884	12,884
	3,221	3,221	3,221	3,221
LR test for IIA	8.49**	8.49**	8.49**	8.49**
log likelihood	-2105	-2105	-2105	-2105
Wald test	1820.35***	1820.35***	1820.35***	1820.35***

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) standardised score	Mother has degree	Father has degree	Whether parent wants student to stay at school	Local unemploye nt rate age 16-19	Local average wage rate age 16-21
<b>Female</b>										
Full-time education	0.058	-0.019	-0.070	0.006	0.046	0.058	0.056	0.077	0.002	-0.006
Apprentice &/or PT education	-0.013	0.029	-0.010	0.001	-0.002	0.009	-0.016	-0.023	0.005	0.007
FT work	-0.018	-0.004	0.037	-0.002	-0.018	-0.023	-0.012	-0.030	0.002	-0.003
NEET	-0.027	-0.006	0.043	-0.004	-0.026	-0.044	-0.027	-0.025	-0.008	0.003
<b>Male</b>										
Full-time education	0.073	-0.016	-0.016	0.006	0.019	0.033	0.080	0.120	0.005	0.009
Apprentice &/or PT education	-0.012	0.036	-0.005	0.002	0.0003	-0.025	-0.027	-0.064	-0.006	-0.003
FT work	-0.029	-0.012	0.018	-0.001	-0.019	-0.028	-0.028	-0.040	-0.012	-0.008
NEET	-0.032	-0.010	0.003	-0.006	-0.001	0.020	-0.024	-0.016	0.013	0.003

Notes: Table 7 is constructed from the nested logit estimates of the Post-Compulsory Education Model shown in Tables 5 and 6 and shows 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)**

	<b>APPR &amp; PTED</b>	<b>FTEMP</b>	<b>NEET</b>
<b>Female Nested Logit (FIML parameter estimates)</b>			
Log(local unemployment rate age 16-19)	0.400 (0.710)	3.736 (2.604)	-2.789 (1.629)*
Log(local unemployment rate)*low ability	-0.647 (1.611)	-5.761 (5.069)	2.855 (3.166)
Log (local average wages - age 16-21)	4.270 (7.445)	-15.468 (13.906)	11.331 (9.389)
Log (local average wages)*low ability	-3.849 (12.678)	14.376 (22.458)	-14.454 (13.772)
Low ability (bottom 10% of attainment) control	9.376 (27.384)	-8.869 (38.392)	17.511 (22.159)
Observations	12,448	12,448	12,448
log likelihood	-1510.01	-1510.01	-1510.01
Wald test	2442.79***	2442.79***	2442.79***
<b>Male Nested Logit (FIML parameter estimates)</b>			
Log(local unemployment rate age 16-19)	-0.516 (0.671)	-0.754 (0.426)*	0.607 (0.447)
Log(local unemployment rate)*low ability	-0.209 (1.401)	-1.846 (1.519)	0.355 (0.989)
Log (local average wages - age 16-21)	-2.517 (4.562)	-4.714 (3.190)	-1.218 (2.588)
Log (local average wages)*low ability	-7.885 (9.795)	-6.372 (13.175)	12.454 (6.987)*
Low ability (bottom 10% of attainment) control	15.410 (19.066)	16.844 (25.650)	-24.407 (12.865)**
Observations	12,884	12,884	12,884
log likelihood	-2094.98	-2094.98	-2094.98
Wald test	2019.45***	2019.45***	2019.45***

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 youths staying in FTED; Number of hours worked during school term.

## APPENDIX

**Table A1: Summary statistics**

	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Key stage 4 (GCSE) standardised score	6333	0.26	0.81	-2.80	1.75
Whether has 5 GCSEs at A*-C	6333	0.57	0.50	0	1
Female	6333	0.49	0.50	0	1
Whether English as additional language	6333	0.22	0.41	0	1
Nonwhite British	6333	0.31	0.46	0	1
Free school meals	6333	0.09	0.29	0	1
Mother has degree	6333	0.11	0.32	0	1
Father has degree	6333	0.14	0.35	0	1
Whether parent wants student to stay at school	6333	0.84	0.37	0	1
Number of hours worked during school term	6333	1.78	3.67	0	37
Attitude to school (scale)	6333	33.81	7.48	1	48
School % of youths staying in FTED	6333	75.87	10.34	38.30	100
Log(local unemployment rate age 16-19)	6333	2.98	0.47	1.77	4.21
Log (local average hourly wages - age 16-21)	6333	1.83	0.07	1.63	2.09

**Table A.2 Probability of full-time education over each of the three alternative choices  
(Females aged 16/17)**

<b>Logit</b>	<b>FTed vs. App&amp; PTed</b>	<b>FTed vs. FTemp</b>	<b>FTed vs. NEET</b>
Log(local unemployment rate age 16-19)	-0.140 (0.256)	-0.255 (0.241)	0.412 (0.237)*
Log (local average wages - age 16-21)	-2.735 (2.208)	0.618 (1.917)	0.981 (1.537)
Key stage 4 (GCSE) standardised 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)
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 youths 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)
<b>Regional dummies</b>	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.3**

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

<b>Logit</b>	<b>FTed vs. App&amp; PTed</b>	<b>FTed vs. FTemp</b>	<b>FTed vs. NEET</b>
Log(local unemployment rate age 16-19)	0.119 (0.229)	0.403 (0.166)**	-0.364 (0.212)*
Log (local average wages - age 16-21)	0.134 (1.581)	2.159 (1.521)	0.607 (1.364)
Key stage 4 (GCSE) standardised 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)*
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 youths 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.4**  
**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
<b>Alternative specification I: Regional level</b>			
Log (regional unemployment age 16-19)	-0.391 (0.238)*	APPR & PTED FTEMP NEET	0.733 (0.225) 0.727 (0.259) 0.581 (1.68)*
			APPR & PTED FTEMP NEET
			0.422 (0.675) -0.018 (0.588) -0.414 (0.498)
Log (average regional wages - age 16-19)	0.793 (1.983)	APPR & PTED FTEMP NEET	57.789 (133.20) * 2.881 (7.303) 7.492 (19.38)
			APPR & PTED FTEMP NEET
			-3.381 (3.351) -1.062 (3.454) -0.556 (2.584)
Sample	3,221	3,221	3,221
log likelihood	-1099.11	-2129.50	-2119.44
<b>Alternative specification II: Three age-based groupings for the wage measure</b>			
Log(local unemployment rate age 16-19)	-0.143 (0.136)	APPR & PTED FTEMP NEET	0.782 (0.159) 0.610 (0.095)*** 1.150 (0.244)
			APPR & PTED FTEMP NEET
			-0.650 (0.506) -0.955 (0.419) 0.410 (0.448)
Log (local average wages 16-17)	-0.404 (0.668)	APPR & PTED FTEMP NEET	0.360 (0.353) 0.434 (0.347) 0.618 (0.541)
			APPR & PTED FTEMP NEET
			-2.315 (2.174) -1.704 (1.667) -0.069 (1.655)
Log (local average wages age 16-21)	-1.099 (1.181)	APPR & PTED FTEMP NEET	0.289 (0.557) 0.156 (0.266) 0.391 (0.713)
			APPR & PTED FTEMP NEET
			-3.583 (4.125) -3.466 (3.727) -0.743 (3.396)
Log (local average wages age > 30)	0.966 (0.611)	APPR & PTED FTEMP NEET	5.325 (4.531) 1.973 (1.722) 5.378 (4.537)**
			APPR & PTED FTEMP NEET
			3.524 (1.911)* -0.415 (1.604) 2.449 (1.488)
Sample	3,194	3,194	12,776
log likelihood	-1088.41	-2097.95	-2082.91

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 youths 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.