Higher education and the impact on health outcomes and behaviour: does the degree choice matter?

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Abstract:
Given recent increases in higher education tuition fees in the United Kingdom, understanding the returns to education has gained importance. This paper focuses on the evaluation of the wider returns to education, more specifically the impact of education on health outcomes and behaviour considering different choices of higher degrees. It is well known that both monetary and non-monetary returns to education differ according to years of schooling, but recently there has been a renewed interest to also evaluate the difference in monetary returns between subject choices. However, little has been done to understand differences in the wider returns as well. By using panel data from the National Child Development Study (NCDS), a longitudinal data from the UK that followed individuals from birth in 1958 to the latest available sweep in 2008, this study tries to understand if there are any differences between health outcomes and health behaviours between individuals with the same educational attainment but with different degree choices. There are clear significant health returns to having a degree and the finding is very robust, but unlike studies that have shown differences in monetary returns, the results also show that there are no significant differences in the effects of education on health across different degrees.

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1. Introduction

In recent decades, education has gained a considerable amount of attention from researchers and policy makers. This is a consequence of the increasing awareness that human capital is an important factor that drives economic growth[2]. The main component of human capital is education, thus it is not surprising that a great deal of attention is put into understanding how and why education helps not only the society but also individuals to improve their socioeconomic wellbeing. Understanding what are the returns to education and further investigating the channels through which education helps increase output and wellbeing can help policy makers concentrate resources on policies that best address these channels in order to maximize cost effectiveness of public spending. Given recent changes in the cost of higher education in the United Kingdom, it has become especially important to understand what exactly are the returns to higher education.

Publicly financed education of children in their early years is widely available across the industrialized world and it is compulsory for children and teenagers to receive education. However, as the individuals get older they have a choice to stop or to continue their education. Therefore, further education is ultimately an individual's choice. They choose to invest in education according to their perception of the returns that they would have and the costs to obtaining further education (Becker 1962; Spence 1973). The costs for the individual can be measured in monetary and non-monetary terms. Tuition fees and other education related expenses as well as forgone earnings during the education period are considered as monetary expenses whilst the effort that must be done in order to complete education is considered a non-monetary cost (Becker, Hubbard and Murphy 2010). In other words, individuals simply do a cost-benefit (returns) analysis.

This paper aims to explore the returns to higher education. These returns can be arranged into four dimensions. The two main dimensions are the *private* returns to education as well as *social* returns and these can be divided into *private/social economic* returns and *private/social non-economic* returns, the latter also often being referred as non-monetary returns or wider returns to education. Each of these dimensions has been subject of different studies and fully evaluating every type of returns to education is necessary in order to assess the total benefits that investments in education can bring to society.

[2] Nelson and Phelps (1966), Lucas (1988), Barro (1991), Mankiw, Romer and Weil (1992), Romer (2006)

Private returns are benefits from education that are reaped solely by the individual. A clear example is the fact that higher educated people tend to earn more income throughout their lifetime (Carneiro, Heckman and Vytlacil 2011), they are less likely to be unemployed and, if they do happen to be unemployed, they spend less time before finding another job (Mincer 1991). These are purely economic returns. On the other hand, social returns can be considered as spill-over effects. More educated people have improved civic participation as they are more likely to participate in community meetings and take part in the political process by voting and reading newspaper as well as give more support to free speech (Milligan, Moretti and Oreopoulos 2004; Dee 2004). The fact that an individual is healthier due to increased levels of education is a private wider return to education but that also means that there will be less strain on public resources as the individual will require less attention and treatment (Wagstaff 1993). Individuals with higher levels of education are also less likely to commit crimes and be incarcerated (Lochner and Moretti 2004). The existence of both social economic returns such as suggested by Nelson & Phelps (1966) and Lucas (1988), and social wider returns previously mentioned, is the main argument used by people that advocate public financing of post-compulsory education as individuals would not take into account spill-over effects and would thus socially under-consume education.

When considering *wider returns to education*, perhaps the most widely studied return to education is the impact on health. The correlation and causality between education and health has been studied in depth in the past few decades. Individuals with further education tend to present better health behaviour and health outcomes. Wider returns to education include better health behaviour and outcomes such as family planning (Currie and Moretti 2003), quitting smoking (Sander 1995), lower obesity levels and self-assessment of health status considered good (Silles 2009). More years of schooling are correlated with better health outcomes such as lower mortality and morbidity rates, fewer working days lost, engagement in vigorous exercises, lower BMI and less incidence of depression (Feinstein 2002 and Silles 2009). Post-compulsory education degrees have also yielded positive effects on health outcomes as well. However, the mechanism through which education affects health is still subject to debate and several researchers have tried to disentangle the connection between education and health. But, while trying to do so, researchers have overlooked the exact impact that post-compulsory education can have on health. For instance, individuals with the same number of years of schooling but who chose different degrees may have very different health behaviour and health outcomes due to that choice.

The focus of this paper is to investigate any differences in the type of degree obtained by individuals and its effect on health outcomes and behaviour. In doing so, additional information can be used to better understand how education can affect health. One of the theories that try to explain the connection between those two variables states that people with higher rates of time preference are more likely to invest both in education and in health (Fuchs 1982, Becker and Murphy 1988). In other words, people with higher rates of time preference are more willing to invest time and effort in activities that have positive results at a later moment in life. Activities such as spending additional years being educated and making an effort to have a healthy lifestyle may be costly and the results are not easily seen or noticed until after a certain amount of time. In this scenario, there is clearly a positive correlation between education and health but no apparent causation between the variables. However, if education does in fact play a role in helping individuals achieve better health outcomes, one would expect that the choice of the degree would yield different positive health outcomes as the curriculum varies significantly across degrees. The focus of analysis is on individuals who had degrees in fields related to Science, Technology, Engineering and Mathematics (STEM), Health, Law, Economics and Management.

This research uses a British longitudinal study, the National Child Development Study (NCDS), a survey that started in 1958 with nearly 17,500 new-borns and attempted to track the same individuals over eight sweeps across time, thus creating a longitudinal study with an extensive amount of socioeconomic information. The 8th and latest available sweep, in 2008, had 9,790 individuals.

The results that were found are in accordance with most of the literature from this topic. The findings suggest a clear impact of higher education qualification on health, especially on self-assessment of health and incidence of disabilities, inadequate Body Mass Index and smoking. The results are robust to different model specifications. However, when comparing differences in wider returns across different subjects, no significant results were found and the hypothesis that the effect on health is the same across degrees cannot be rejected.

The remainder of this paper is structured in the following way. Section 2 presents the existing related literature on this topic. This is followed by section 3 in which the methodology used for the analysis is described. Section 4 presents the data used for this research and descriptive statistics of the sample used in the study. Section 5 presents the results with several different specifications as well as discusses what they mean. The last section contains the conclusion.

2. Theoretical and empirical background

Education has been linked to a number of positive outcomes, both for the individual partaking in education and for the society. The main objective of this paper is to discover whether there is a difference in health outcomes from individuals with and without higher education degrees and also for those individuals with the same level of education, but who chose different degrees. It is important, however, to understand the channels through which education may affect health behaviour and health outcomes.

Several theories have tried to explain the relationship between schooling and health, which was first discovered in the seminal work of Kitagawa and Hauswer (1973) when they showed that mortality fell with educational attainment along with other socioeconomic variables. The work of Grossman (1976) is a starting point in which an attempt is made to understand the correlation between education and health. As Grossman observes, years of formal schooling is an important correlate of good health, as shown in mortality rates, morbidity rates and self-evaluation of health status. Regardless of the measure used, the results remain the same. The results also hold whether the analysis is made with individuals or groups. Grossman also stated that each household has a health production function and that schooling increases the efficiency of the production of health. From that point on, several researchers have found empirical evidence that support this hypothesis such as, Berger and Leigh (1989), Mirowsky and Ross (2003), Currie and Moretti (2003), Lleras-Muney (2005) Cutler and Lleras-Muney (2006).

The observed correlation between health and education can be explained by three different theories according to the literature. The first hypothesis states there is a causal relationship from schooling to better health outcomes and health behaviour. This means that investments in education would have non-economic effects on health. Grossman (2004) did a review of studies (which were forthcoming at the time) that tried to evaluate this causality hypothesis through the use of more sophisticated methods. Although Grossman argues that they are necessary to differentiate correlation from causality, OLS estimates presented in these studies are probably biased but they seem to give a lower bound of the effect of education on health.

Llera-Muney (2005) used synthetic cohorts of U.S. censuses from 1960, 1970 and 1980 along with changes in compulsory education laws as instrumental variables for education. Since this instrument is highly unlikely to be correlated with unobserved determinants of education and health, such as time preference and tastes, the estimates seem to be more

accurate. She studied the effects of education on adult mortality and suggested that OLS and IV estimates are not statistically different, but whilst OLS estimates show that an additional year of schooling yields a 1.3 percentage point lower probability of dying within the next 10 years, IV estimates are much larger: 3.6 percentage points lower probability for each additional year.

Arendt (2005) did similar work with data from Denmark in 1958-1975 and 1990-1995 periods. Using compulsory school reforms in former period he evaluated the impact of schooling on self-rated health, body mass index and smoking behaviour. Although the research is subject to some criticism, he found significant effects of schooling on self-rated health with IV estimates being larger than OLS estimates.

Currie and Moretti (2003) studied the effect of maternal education on birth outcomes in the United States using information from 1970-2000. They used information availability of colleges in the woman's county in her 17^{th} birthday as an instrument to control for endogeneity of educational attainment. They found a positive effect of mother's schooling on child's birth weight as well as a reduced probability of smoking during pregnancy which can clearly have an effect on a new-born's health outcomes. The IV estimates again suggest a higher impact than what is shown in OLS estimates.

In the United Kingdom, data also shows a positive relationship between education and health according to qualitative and quantitative studies. Hammond (2004) did a qualitative study with adults living in three rural areas from England and concluded that adult learning had improved psychosocial qualities such as self-esteem, stress and recovery from mental health difficulties. Feinstein (2002), Feinstein & Hammond (2004) and Chevalier & O'Sullivan (2007) did quantitative studies to try to mitigate possible estimation bias and evaluate the causality stemming from education to health outcomes.

In 2002, Feinstein used data from the 1970 British Cohort Study (BCS70) and the NCDS along with Propensity Score Matching (PSM) estimation technique to reduce bias of the estimates. He found that the effects of education on depression appeared to be stronger than the ones on obesity, but there was a clear indication of effects on both health measures. Despite the PSM strategy was unlikely to completely deal with selection bias, the general results seemed to be robust.

Feinstein and Hammond (2004) used another method to deal with selection bias in the NCDS cohort. They argue that individuals partaking in adult learning (vocational or academic) could be systematically different from those who did not. For example, individuals could differ in their levels of ambition. However, if the analysis is done with the *changes* in

outcomes instead of *levels* at a single point in time, then this bias could be greatly reduced since the level of ambition can be considered constant over time for the same individual. Selection bias can still remain, especially if there is an unobserved event that causes individuals to change their perceptions and tastes, but the authors argue that this can be dealt with, to a certain extent, with controls for sources of confounding bias. Among the many results, they find that adults taking between three to ten vocational courses between ages 33 and 42 increase their probability of giving up smoking by 7.3%.

Chevalier and O'Sullivan (2007) used changes in compulsory school leaving age in 1947 in the UK as instrument along with data from NCDS to show that mothers with an additional year of education increased birth weight of their children by 75g or 2%. They go on to also briefly analyse economic returns say that this increase could translate into a total benefit of £2,000 per treated child for mothers that were affected by the school compulsory law. As shown before, the OLS estimates seem to give a lower bound to the effect of education on health.

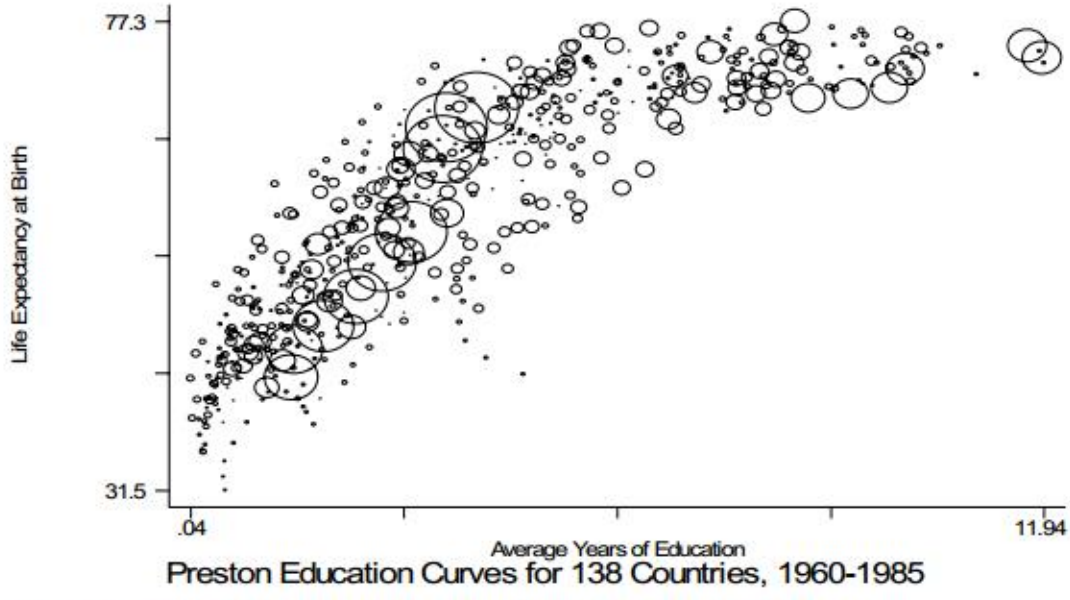
The second hypothesis that explains the correlation between education and health argues that the causality is reversed, meaning that better health outcomes and behaviour cause improved educational outcomes (years of schooling, test scores, school enrolment). For example, children with poor health may have more difficulties learning. Following the work of Behrman (1996), Glewwe and Miguel (2008) did a review of the impact of health and nutrition on educational outcomes such as fewer years enrolled in school, lower daily attendance and less efficient learning per day in school. Results from several studies indicate that poor nutrition and health status impair educational achievements, regardless of using data from different developing countries, with cross-section and panel information and with different methodologies. Another study, using more sophisticated methods, shows similar results. Ding et al. (2009) used students' genetic markers in the United States as instrumental variables to estimate the negative effect of Attention Deficit Hyperactivity Disorder (ADHD), depression and obesity on student's test scores. Their findings also support the hypothesis that better health status leads to improved performance on test scores.

The third hypothesis suggests that, in fact, there is no causal relationship between education and health. Differences in a third variable, such as rates of time preference and other taste variables could be the reason why education and schooling are positively correlated. According to this theory, investments in education would have no spillover effect on health and vice-versa. This theory was tested by Fuchs (1982) in an exploratory study with 500 men and women in the United States. Fuchs showed that the correlation between

education and health could be explained by the individual's time preference. But he explained that he could not rule out the possibility that education could lower time discount rates which would lead individuals to invest more in health which would, in turn, have spillover effects after all. In fact, exogenous variations in education seem to validate this possibility as it was shown by Lleras-Muney (2005) and Currie and Moretti (2003) through the use of instrumental variables and quasi-natural experiments.

Regardless of which theory is correct, and in fact more than one theory may be correct, the positive correlation between health and education is well documented and it is very clear to see it as shown by Cutler and Lleras-Muney (2006) on figure 1, which shows the relationship between life expectancy at birth and years of education. The figure does not control for other covariates, but even when most socioeconomic variables are added, the positive correlation can still be observed.

Figure 1: The relationship between education and life expectancy across countries



Note: Circle size proportional to country population. Authors' calculation using the Barro-Lee international data.

Source: Cutler and Lleras-Muney (2006)

3. Methodology

The dependent variables used in this research are all binary, so it is possible to estimate the effect of education on health by using a linear probability model such as:

$$H_{it} = \alpha + \beta_{1t} degree_{it} + \boldsymbol{\vartheta X}_{it} + \beta_{2t} H_{it-1} + u_i + \varepsilon_{it} \qquad (1)$$

In which the health variable H_{it} is a function of a constant, plus a binary variable indicating whether or not an individual has a degree or has a degree related to a particular field of knowledge, plus a set of control variables $\boldsymbol{X}$, a lagged health variable, an unobserved time invariant individual effect u and finally a zero-mean error ε uncorrelated with the regressors.

However, one of the problems with the linear probability model is that it may yield probabilities that are lower than zero or higher than one, which are meaningless. Thus, the estimations were done with the following model:

$$\Pr(y = 1|\boldsymbol{x}) = G(\boldsymbol{x\beta}) \qquad (2)$$

The regressors are given by $\boldsymbol{x}$ and the function G takes on values strictly between zero and one and is non-linear. The most common suggestions in the literature for describing this function are the probit and logit functions. This study uses the probit function, given by:

$$G(\boldsymbol{x\beta}) = \boldsymbol{\gamma}(\boldsymbol{x\beta}) \equiv \int_{-\infty}^{\boldsymbol{x\beta}} \gamma(v)dv \qquad (3)$$

with,

$$\gamma(v) = \frac{1}{\sqrt{2\pi}} exp\left(-\frac{v^2}{2}\right) \qquad (4)$$

The standard normal density is given by $\gamma(v)$.

Data from NCDS was used to calculate (2) according to different sets of controls and explanatory variables of interest. The first set of regressions was done with no controls followed by *model 2* in which controls for region of birth[3] as well as a dummy for males were added. *Model 3* included the individual's current region and socioeconomic information from the parents': their weekly income, marital status in 1958, whether or not they went into post-compulsory education and their social class. *Model 4* included additional socioeconomic information from the individuals' household: marital status in each survey (from 1981 to 2008), whether or not they had a child and their household weekly labour income.

4. Data

In order to estimate the effects of education on health this study used data from the second oldest birth cohort study in the United Kingdom, *The National Child Development*

[3] The United Kingdom was divided into ten regions: Scotland, North (England), Northwest, Yorkshire and Humber, East of England, East Midlands, West Midlands, Southeast, Southwest,

Study (NCDS), which is a longitudinal survey that started in 1958. All babies that were born in England, Scotland and Wales in a given week in March 1958 participated in this survey, a total of 17,415 new-borns. The survey at the time was called Perinatal Mortality Survey (PMS). Since then, nine additional sweeps where done and there is funding for an additional sweep, planned to occur in 2018. Table 1 displays information for each year of sweep, age and number of individuals interviewed for the NCDS. The 8th and last sweep with available data had 9,790 individuals, whilst the following sweep was held in 2013. The announced timetable suggests this 9th sweep will be made available in early 2015. In the first three follow-up surveys there were efforts to include immigrants that were born in the same week as the original cohort and that were permanently established in Britain. No further attempts were made after sweep 3, so the immigrants are under-represented from sweep 4 onwards. There were 380 immigrants added on the first follow-up, 651 on the second follow-up and 929 on the third follow-up survey, sweep 3.

Table 1 – Information about sweeps and individuals interviewed for NCDS.

Sweep	**Year**	**Age**	**Target Sample**	**Individuals interviewed**
0	1958	Birth	17,638	17,415
1	1965	7	17,370	15,425
2	1969	11	16,880	15,337
3	1974	16	16,929	14,654
4	1981	23	16,713	12,537
5	1991	33	16,389	11,469
6	2000	42	16,194	11,419
7	2004	46	16,072	9,534
8	2008	50	16,014	9,790
9	2013	55	Pending	Pending
(10)	(2018)	(60)	Pending	Pending

Source: Centre for Longitudinal Studies and Institution of Education – University of London.

Apart from sample loss caused by individuals that permanently leave the UK, that cannot be located due to changes to new addresses within the UK and also non-response to efforts of tracing them, refusal to participate in the survey also contribute to sample loss

although it is low. On sweep 4 in 1981 the refusal rate was 7.1%, the following sweep at age 33 had 11.1% refusal rate and at age 42, 13.2%[4]. The table A.1 in the appendix shows the attrition throughout the years for individuals that informed their level of schooling in 1981. In 2008, 75.22% of the individuals with degree in 1981 and 70.53% of the individuals with no degree were still in the sample.

As members of the NCDS cohort aged, the surveys had different objectives and the information collected was different as well. The original focus when the PMS took place was to address social and obstetric factors that were linked with stillbirth and neonatal deaths since at the time these rates were not falling. The data was collected from doctors and midwives that filled out medical records as well as parents who provided socioeconomic information. As the survey took on a longitudinal style study, family background, cognitive and behavioural development and educational achievement were the main focus in early years (ages 7, 11 and 16) and the data was collected through house visits in which the parents provided information along with educational and medical assessments. Teachers also provided information from schools and the subjects themselves completed ability tests. As the individuals moved on to adulthood and are now in late middle age, information such as vocational education and training, employment and health outcomes became the focus of the survey and the information was collected from the cohort members through structured interviews and questionnaires. The individuals started answering the surveys by themselves at age 23, on sweep 4 in 1981.

The NCDS is not exactly a panel. The same questions were not asked in every single sweep, mainly because the focus of the study changed throughout time. However, a set of core questions were repeated throughout sweeps 4 to 8, which made it possible to create a panel with the information from the study with the necessary variables for the estimation model. Table 2 presents the health related information collected in 1981, 1991, 2000, 2004 and 2008 and that were used as dependent variables. It also contains a brief explanation of how derived variables were created and how some questions were asked in the questionnaires with the exact same words throughout the sweeps.

[4] Centre for Longitudinal Studies – NCDS and BCS70 Technical Report

Table 2 – Description of dependent variables used.

Variable	Description
Excellent Health	Binary variable; Indicates individual considers own health to be excellent (options are excellent, good, fair or poor).
Disabilities/Illnesses	Binary variable; Individual has a long standing illness or disability.
Inadequate BMI (underweight; overweight)	Binary variable; Individual's Body Mass Index is below 18.5 (underweight) or above 25 (overweight or obese).
Smoker	Binary variable; Indicates individual smokes at least once a day.
Hazardous Drinking	Binary variable; Men consume over 21 units of alcohol per week; women consume over 14 units of alcohol per week.
Backache	Binary variable; "Do you often have backaches?"
Tired	Binary variable; "Do you feel tired most of the time?"
Sad	Binary variable; "Do you often feel miserable or depressed?"
Worried	Binary variable; "Do you often get worried about things?"
Rage	Binary variable; "Do you often get in a violent rage?"
Scared	Binary variable; "Do you often suddenly become scared for no reason?"
Upset	Binary variable; "Are you easily upset or irritated?"
Jittery	Binary variable; "Are you constantly keyed up and jittery?"
Nervous	Binary variable; "Does every little thing get on your nerves and wear you out?"
Heart Race	Binary variable; "Does your heart often race like mad?"

Source: National Child Development Study, sweeps 0-8.

Table 3 presents the description of explanatory variables used in this study. All are binary variables with the exception of the natural logarithm of parent's income measured in 1958 and the natural logarithm of household's labour income measured in 1981 (sweep 4) and sequentially until 2008 (sweep 8). The income was deflated using the Retail Price Index (RPI)[5]. The information about parents' education and social class was derived from information contained in the 1958 initial PMS, parent's income was collected in the initial

[5] The RPI tables are provided by the Office for National Statistics, United Kingdom.

survey and the three follow-up sweeps and all remaining variables were collected from sweeps 4 (1981) to sweep 8 (2008).

Table 3 – Description of explanatory variables used.

Variable	**Description**
Degree	Binary variable; indicates individual has a first degree. For other specifications, it indicates having a degree from a subject in particular.
Parents Post-Compulsory education	Binary variable; indicates both parents went on to further education after schooling leaving age.
Parental Social Class	Binary variable; indicates parents' social class is considered "White Collar"
Parental Income(log)	Natural log of parent's weekly income in 1958
Employed	Binary variable; indicates individual is (self)employed
Male	Binary variable; indicates individual is male
Married	Binary variable; indicates individual is married
Has children	Binary variable; indicates individual has children
Household Labour Income(log)	Natural log of household's labour income

Source: National Child Development Study, sweeps 0-8.

Due to attrition and non-response, not every individual informed their highest academic degree in every sweep. On top of that, the survey's questionnaires asked what was the individual's highest academic achievement since the last sweep, not in their lifetime. In order to create an independent variable of interest with the largest number of observations possible, information that was collected in previous sweeps were kept in the sample in following surveys despite the fact that in any particular survey that information might be missing. In other words, as long as it was known that the individual had a degree, this information was recorded regardless of whether the individual provided this information in following sweeps or not. This explains why, on table 4, the number of observations is increasing despite the fact that the achieved sample has been reduced over the years.

Table 4 – Number of observations for graduates and non-graduates.

	Sweep 4 1981	Sweep 5 1991	Sweep 6 2000	Sweep 7 2004	Sweep 8 2008
Graduates	1,235	1,448	2,021	2,156	2,497
Non-Graduates	2,457	3,489	4,346	9,046	9,616
Total	3,692	4,937	6,367	11,202	12,113

Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Table 5 shows the descriptive statistics of the panel sample with six observations throughout time (1958, 1981, 1991, 2000, 2004 and 2008). Considering it's a panel setting with more than 9,000 individuals followed in six different moments in time, it is not surprising the lowest number of observations for a variable is over 38,000. It is possible to see that there was an increase in higher education attainment between generations. Close to 10% of the subject's parents had pursued further education after school leaving age while more than 24% of the 1958 cohort went on into having a higher degree at some point in their lives.

Table 5 – Descriptive statistics of dependent and independent variables.

Variable	Mean	Standard Deviation	Observations
Degree	0.2442	0.4296	38311
Excellent Health	0.3256	0.4686	51235
Backache	0. 2131	0.4095	41716
Tired	0.2417	0.4281	41714
Sad	0.1637	0.3700	41683
Worried	0.4132	0.4924	41733
Rage	0.0454	0.2082	41730
Scared	0.0735	0.2610	41733
Upset	0.2137	0.4099	41735
Jittery	0.0527	0.2234	41729

Nervous	0.0429	0.2026	41721
Heart Race	0.0736	0.2611	41718
Disabilities/Illnesses	0.2453	0.4303	51280
Inadequate BMI	0.4081	0.4915	38870
Individual smokes	0.0349	0.4722	47371
Hazardous drinking	0.2677	0.4427	42532
Married parents	0.8737	0.3322	74440
Post-compulsory education of parents	0.1021	0.3028	71670
Parental social class	0.1941	0.3955	72065
Parental income(log)	5.4617	0.7029	38730
Male	0.4948	0.4999	51429
Married	0.6349	0.4814	51073
Has children	0.3886	0.4874	51082
Household labour income(log)	6.1376	2.1707	36078

Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Similar descriptive statistics are available on the appendix (table A.2) for the subsample of individuals from the 1958 cohort that informed the subject of their degrees in the year 2000, sweep 6. A total of 829 individuals informed their degree choices.

5. Results

As a benchmark for interpretation of the results, the analysis was initially done in a standard way evaluating the effect of having a higher degree or postgraduate degree on health. Studies about education and health show a positive correlation between both variables and this result was expected to be shown in our benchmark analysis. The initial hypothesis was partially correct as seem on table 6, which shows the marginal effects of a probit regression. All the health related variables were significantly affected by education when no socioeconomic controls were added, with the exception of hazardous drinking. Introducing controls for region slightly changed the magnitude of the effects, but not the significance. Adding socioeconomic controls reduced the magnitude and significance of several malaises

and once all socioeconomic controls were added, the significant effects could be seen for self-assessment of health, incidence of backache and disabilities/illnesses, inadequate BMI and smoking, but not for malaises.

Table 6 – Impact of having a degree on health outcomes and health behaviours.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.1102***	0.1053***	0.0517***	0.0490***
Backache	-0.0400***	-0.0395***	-0.0427***	-0.0345***
Tired	-0.0299***	-0.0241***	-0.0089	0.0084
Sad	-0.0378***	-0.0352***	-0.0216**	-0.0000
Worried	-0.0545***	-0.0423***	-0.0376*	-0.0071
Rage	-0.0031***	-0.0028***	-0.0015	-0.0000
Scared	-0.0153***	-0.0139***	-0.0055*	-0.0016
Upset	-0.0424***	-0.0380***	-0.0340***	-0.0123
Jittery	-0.0069***	-0.0060***	-0.0023	0.0009
Nervous	-0.0082***	-0.0077***	-0.0049**	-0.0016
Heart Race	-0.0180***	-0.0168***	-0.0113***	-0.0052
Disabilities/Illnesses	-0.0802***	-0.0855***	-0.0480***	-0.0544***
Inadequate BMI	-0.1167***	-0.1281***	-0.0895***	-0.0968***
Smoker	-0.0714***	-0.0713***	-0.0580***	-0.0632***
Hazardous Drinking	0.0036	-0.0019	-0.0085	-0.0099

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Having a higher degree had no significant effect at all on hazardous drinking, even when no controls were added. This may be explained by the fact that even though heavy drinking has been known for a long time to be bad for health, the parameters set by the National Health Service that were used to create this variable were not of general knowledge until recently, which means the 1958 cohort was not aware of the healthy limits of drinking alcohol.

A separate analysis was done to evaluate differences in gender. Table A.2 (see appendix) shows results separately for males and females. Since the sample is roughly split in half for each estimation, the loss in the level of significance for the coefficients was expected. The pattern of results remains largely unchanged and it is possible to see that the effects seem to be larger for males than for females, with the exception of incidence of backache. One particular result stands out, having a degree for males reduces incidence of inadequate BMI by almost twice as much as it does for females. It is the largest difference in the results for males and females.

The inadequate BMI variable was measured as a binary variable indicating BMI lower than 18.5 or larger than 25. Table 7 shows more details about poor levels of BMI. The analysis was done separately with dependent variables that captured levels too low or too high as well as for males and females only. Results indicate that the effect of having a degree is significant in reducing incidence of being overweight but not underweight and the impact is stronger for males than for females. This result might be explained by the fact that being underweight is usually related to mental disorders such as anorexia and bulimia which are hard to treat and have much more to do with life traumas than with education and knowledge, which means having a degree would not make a difference on the probability of being underweight.

Table 7 – The impact of a degree on Body Mass Index problems.

Variable	No controls	Model 2	Model 3	Model 4
Under_bmi	0.0009	0.0019*	0.0052	0.0022
Over_bmi	-0.1211***	-0.1401***	-0.0906***	-0.0985***
Men				
Under_bmi	0.0000	0.0000	0.0000	0.0000
Over_bmi	-0.1452***	-0.1433***	-0.1078***	-0.1084***
Women				
Under_bmi	0.0038	0.0039	0.0107	0.0101
Over_bmi	-0.0965***	-0.0947***	-0.0785***	-0.0970***

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Some robustness checks were conducted to test particular hypothesis. One of them aimed to explore the channels through which having a higher education degree impacts the probability of having an inadequate BMI. It can be argued that individuals with lower qualifications may be employed in jobs that require more physical effort which in turn would lead to gain of muscular mass, thus increasing body weight and BMI levels. But, when controlling for employment, the effects have a small reduction and the hypothesis that the effects are the same cannot be rejected. Results can be seen on table A.3 in the appendix.

Another hypothesis considers that having a degree does not necessarily have an impact on health, it is actually the university experience that has an impact on health. The interaction with students, the contact with university staff, workshops, talks and lectures would have a greater impact. Spending one or two years in the university to receive a diploma or certificate, according with this hypothesis, would mean that we would observe a reduction in the effect of having a degree. Again, this hypothesis does not find support in the data. Results presented on table A.4 on the appendix do not show a large reduction in the size of the coefficients or the significance and these changes cannot be credited to this hypothesis as they still lie within the confidence interval of previous estimates.

These results show that the methodology used presents results similar to the ones found in the literature, indicating an impact that stems from education to health. The contribution of this paper, however, lies on the analysis of wider returns to education according to subject choice. Two main groups of degrees were chosen for analysis. The first group is formed by individuals who had a degree in fields related to Science, Technology, Engineering and Mathematics (STEM) plus Health, forming a STEMH sample. Individuals with degrees from those fields were compared to individuals who had degrees from other fields of knowledge. The results are presented on table 8. The estimates do not show a clear picture and it is not possible to clearly say that there are different wider returns between STEMH degrees and other subjects. The few health variables that seem to be significantly affected by a degree from the related field do not display a robustness of either magnitude or significance as controls are added to the estimations.

Table 9 – Impact of a STEMH degree on health outcomes and health behaviour.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.0107	0.0006	0.0589	0.0679
Backache	0.0133	0.0082	0.0117	0.0304

Tired	-0.0427	-0.0369	-0.0626	-0.0653
Sad	-0.0093	-0.0023	-0.0330	-0.0462
Worried	-0.1043**	-0.0746	-0.1365**	-0.1340*
Rage	-0.0023	-0.0020	-0.0000	-0.0000
Scared	-0.0146**	-0.0134**	-0.0160	-0.0190**
Upset	-0.0529***	-0.0505***	-0.0500	-0.0526
Jittery	-0.0014	0.0015	-0.0000	-0.0001
Nervous	-0.0011	-0.0001	-0.0000	0.0000
Heart Race	-0.0037	-0.0058	-0.0001	-0.0000
Disabilities/Illnesses	0.0434	0.0369	-0.0102	-0.0394
Inadequate BMI	-0.0353	-0.0376	-0.0598	-0.1167
Smoker	0.0013	0.0040	0.0450	0.0636*
Hazardous Drinking	0.0427	0.0343	0.0331	0.0018

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

The results for Law, Economics and Management (see table A.5 on appendix) show even less evidence of differences between wider returns of different degrees. Given that the exact same model was able to find differences between individuals with and without higher degrees, there are two possible explanations for the lack of significant effects when evaluating differences between degrees. The first one is that simply there are no differences in wider returns between degrees, unlike there are differences in economic returns as seen on Walker and Zhu (2011). The second explanation is that the subsample of individuals who informed their degrees is not representative of the whole 1958 cohort.

To test this second explanation, the same estimations were made, this time comparing individuals that informed their degree choices with individuals that did not have a higher education degree. The idea was to find the similar results to the ones found in the complete sample. The results of these estimations can be seen on table A.6 in appendix. For this subsample, the only health variables that are affected by having a degree are self-evaluation of health and the incidence of frequent smoking. All other health indicators do not show any evidence of being affected by having a degree. This tells us two things; first, the subsample

chosen to evaluate differences in wider returns between degrees is not entirely adequate as it does not replicate the results encountered in the larger sample. Second, even for self-assessment of health and incidence of smoking, in which positive and significant results were found, the results do not show any significance when evaluating differences between degrees. This leads to the conclusion that although the subsample used is not perfect, it does shows signs that there is, in fact, no difference in wider returns between degrees.

6. Conclusion

Education and economic growth have been known to be correlated for a long time as well as the correlation of education with a number of other positive outcomes. Alongside that, given recent changes in the cost of higher education in the United Kingdom, it has become especially important to understand what exactly are the returns to higher education. This research focuses on the wider returns to education, more specifically, the impact of higher education on health outcomes and behaviour. The main contribution of this paper is that it also explores the differences in wider returns to education according to degree choice.

The analysis was carried on through a probabilistic model with probit estimations using panel data, although logit estimations and even OLS estimations yielded similar results. The data used for this study comes from the National Child Development Study (NCDS), a longitudinal British survey that started in 1958 and that has eight follow-up sweeps since then made available to the public, the last one being carried out in 2008. At the beginning, more than 17,000 participated in the survey and more than 9,000 still remain.

To test the validity of the estimation model used in this research, the first analysis was used on the entire 1958 cohort, comparing individuals that had a higher education degree with those who did not. Results showed that there was a significant positive impact of education on health outcomes and behaviour. Individuals with a degree were less likely to have backache, to be a smoker, have inadequate BMI or disabilities and illnesses. They were also 4.9% more likely to self-assess their health as being excellent in comparison with individuals with no degrees. Some robustness checks were done with different model specifications to test different hypothesis but the results remained largely the same and were more pronounced for males.

When evaluating a subsample for differences in wider returns according to individuals with degrees in fields related to Science, Technology, Engineering, Mathematics and Health (STEMH) and Law, Economic and Management (LEM), results did not show any significant

difference in health behaviour and status. However, the subsample lacked statistical power and was not a perfect representation of the NCDS cohort. The same analysis between individuals with and without degree was done with the subsample and the impact of education on health was significant only for self-assessment of health and being a smoker.

A few caveats need to be addressed though. Despite having indications that there are no differences in the wider returns to education between different degrees, the results are far from being conclusive. More data, with better quality, needs to be used for the estimations as well as a more refined model that can clearly separate correlation from causality. Clearly there is need for further research. Another limitation of this work is that it does not explore the hypothesis that the effect of education on health may vary over time. Individuals with higher education degrees may eventually have poor health but this may take longer than it does for people without a degree. The use of subjective measures of health is also a problem, but this is not something new in the literature and by using several different measures of health this problem is, to some extent, addressed.

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Appendix

Table A.1 – Attrition for individuals that informed their education level in 1981.

Year	Degree	Proportion	Variation*	No Degree	Proportion	Variation*
1981	1235 (100%)	33.45%	-	2457 (100%)	66.55%	-
1991	716 (57.97%)	33.12%	-42.02%	1446 (58.85%)	66.88%	-41.15%
2000	1013 (82.02%)	33.62%	41.48%	2000 (81.40%)	66.38%	38.31%
2004	925 (74.90%)	34.16%	-8.69%	1783 (72.57%)	65.84%	-10.85%
2008	929 (75.22%)	34.90%	0.43%	1733 (70.53%)	65.10%	-2.8%

Source: Author's own calculations using the National Child Development Study, sweeps 0-8.
*$(year_t/year_{t-1}) - 1$

Table A.2 – Descriptive statistics of subsample of individuals with a STEMH degree.

Variable	Mean	Standard Deviation	Observations
Degree in STEMH	0.2768	0.4475	3024
Excellent Health	0.3717	0.4833	2564
Backache	0.1576	0.3645	1891
Tired	0.2258	0.4183	1891
Sad	0.1360	0.3429	1890
Worried	0.3712	0.4833	1891
Rage	0.0323	0.1768	1890
Scared	0.0513	0.2207	1891
Upset	0.1698	0.3755	1891
Jittery	0.0407	0.1977	1891
Nervous	0.0280	0.1651	1891
Heart Race	0.0323	0.1768	1890
Disabilities/Illnesses	0.2595	0.4384	2563
Inadequate BMI	0.4019	0.4904	1575
Smoker	0.1764	0.3812	2455
Hazardous Drinking	0.2876	0.4528	2225
Married parents	0.9060	0.2919	2616
Post-Compulsory education of parents	0.2558	0.4364	2592
Parental Social Class	0.3000	0.4583	2414
Parental Income(log)	3.3747	0.7252	1181
Male	0.5415	0.4984	2565
Married	0.6448	0.4786	2562
Has children	0.3393	0.4736	2561
Household Labour Income(log)	7.3569	2.2589	2108

Table A.3 – Impact of having a degree on health outcomes and health behaviours.

Variable	No Controls		Model 2		Model 3		Model 4	
	M	F	M	F	M	F	M	F
Excellent Health	0.1206***	0.0970***	0.1192***	0.0912***	0.0648***	0.0375**	0.0682***	0.0312
Disabilities/Illnesses	-0.0734***	-0.0884***	-0.0783***	-0.0921***	-0.0510***	-0.0486***	-0.0654***	-0.0475**
Inadequate BMI	-0.1565***	-0.0952***	-0.1549***	-0.0949***	-0.1112***	-0.0597*	-0.1563***	-0.0843**
Smoker	-0.0581***	-0.0555***	-0.0539***	-0.0601***	-0.0572***	-0.0662***	-0.0646***	-0.0624***
Hazardous Drinking	-0.0167	0.0102	-0.0238*	0.0118	-0.0102	-0.0090	-0.0065	-0.0212
Backache	-0.0330***	-0.0445***	-0.0330***	-0.0447***	-0.0301**	-0.0545***	-0.0230	-0.0437***
Tired	-0.0162*	0.0326**	-0.0156*	-0.0297**	-0.0212	0.0185	-0.0145	0.0289
Sad	-0.0235***	-0.0483***	-0.0244***	-0.0456***	-0.0200*	-0.0202	-0.0101	-0.0021
Worried	-0.0443***	-0.0462***	-0.0466***	-0.0338*	-0.051**	-0.0143	-0.0151	-0.0103
Rage	-0.0017*	-0.0028	-0.0016*	-0.0024	-0.0016	0.0018	-0.0001	0.0052
Scared	-0.0043***	-0.0244***	-0.0046***	-0.0228***	-0.0014	-0.0075	-0.0002	-0.0053
Upset	-0.0235***	-0.0533***	-0.0233***	-0.0505***	-0.0278**	-0.0435*	-0.0131	-0.0216
Jittery	-0.0039***	-0.0073***	-0.0038**	-0.0059**	-0.0016	0.0008	-0.0003	0.0029
Nervous	-0.0055***	-0.0090***	-0.0061***	-0.0080***	-0.0088**	-0.0016	-0.0055	0.0005
Heart Race	-0.0111***	-0.0231***	-0.0116***	-0.0215***	-0.0071**	-0.0140**	-0.0021	-0.0094

Note: Significance level – *** 1%; ** 5%; * 10%.

Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Table A.4 – Impact of having a degree on health outcomes and health behaviours – employment added as control in model 4.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.1102***	0.1053***	0.0517***	0.0453***
Backache	-0.0400***	-0.0395***	-0.0427***	-0.0301***
Tired	-0.0299***	-0.0241***	-0.0089	0.0160
Sad	-0.0378***	-0.0352***	-0.0216**	0.0053
Worried	-0.0545***	-0.0423***	-0.0376*	-0.0049
Rage	-0.0031***	-0.0028***	-0.0015	-0.0002
Scared	-0.0153***	-0.0139***	-0.0055*	-0.0008
Upset	-0.0424***	-0.0380***	-0.0340***	-0.0138
Jittery	-0.0069***	-0.0060***	-0.0023	0.0010
Nervous	-0.0082***	-0.0077***	-0.0049**	-0.0015
Heart Race	-0.0180***	-0.0168***	-0.0113***	-0.0049
Disabilities/Illnesses	-0.0802***	-0.0855***	-0.0480***	-0.0443***
Inadequate BMI	-0.1167***	-0.1281***	-0.0895***	-0.0923***
Smoker	-0.0714***	-0.0713***	-0.0580***	-0.0623***
Hazardous Drinking	0.0036	-0.0019	-0.0085	-0.0217

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Table A.5 – Impact of having a degree on health outcomes and health behaviours – diploma/certificate variable added as control in model 4.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.1102***	0.0648***	0.0581***	0.0456***
Backache	-0.0400***	-0.0395***	-0.0377***	-0.0305***
Tired	-0.0299***	-0.0241***	-0.0068	0.0122
Sad	-0.0378***	-0.0352***	-0.0202**	0.0027
Worried	-0.0545***	-0.0423***	-0.0343*	-0.0020
Rage	-0.0031***	-0.0028***	-0.0016	-0.0001
Scared	-0.0153***	-0.0139***	-0.0054*	-0.0011
Upset	-0.0424***	-0.0380***	-0.0333***	-0.0128
Jittery	-0.0069***	-0.0060***	-0.0022	0.0011
Nervous	-0.0082***	-0.0077***	-0.0050**	-0.0015
Heart Race	-0.0180***	-0.0168***	-0.0110***	-0.0046
Disabilities/Illnesses	-0.0802***	-0.0599***	-0.0448***	-0.0535***
Inadequate BMI	-0.1167***	-0.1281***	-0.0900***	-0.0947***
Smoker	-0.0714***	-0.0510***	-0.0546***	-0.0587***
Hazardous Drinking	0.0036	-0.0051	-0.0327**	-0.0179

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Table A.6 – Impact of a LEM degree on health outcomes and health behaviour.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.0883*	0.0045	-0.0004	-0.2106
Backache	-0.0153	-0.0101	-0.0259	-0.0436
Tired	-0.0215	-0.0016	-0.0113	-0.0281
Sad	-0.0120	-0.0149	-0.0468	-0.0589*
Worried	-0.0237	0.0046	-0.0809	-0.0881
Rage	0.0057	0.0040	-0.0000	-0.0000
Scared	-0.0032	-0.0027	0.0008	-0.0011
Upset	0.0211	0.0273	-0.0558*	-0.0450
Jittery	0.0005	0.0001	-0.0000	-0.0000
Nervous	-0.0002	-0.0003	-0.0000	-0.0000
Heart Race	0.0005	0.0006	0.0005	0.0008
Disabilities/Illnesses	0.0245	0.0064	0.0140	0.0268
Inadequate BMI	0.1447***	0.1262**	0.1340	0.1787
Smoker	-0.0289**	-0.0136	-0.0289	-0.0039
Hazardous Drinking	-0.0086	-0.0512	0.0099	0.0113

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.

Table A.7 - Impact of having a degree on health outcomes and health behaviours – Results for subject sample – Dependent variable is a dummy equal to one if subject of degree is known and zero if the individual does not have a first degree.

Variable	No controls	Model 2	Model 3	Model 4
Excellent Health	0.0793***	0.0607***	0.0764***	0.0496***
Backache	-0.0221**	-0.0180*	-0.0224	-0.0178
Tired	-0.0152	-0.0064	0.0003	0.0202
Sad	-0.0277***	-0.0227**	-0.0006	0.0311
Worried	-0.0470***	-0.0269	-0.0156	0.0190
Rage	-0.0004	-0.0008	0.0010	0.0008
Scared	-0.0131***	-0.0116***	-0.0011	0.0030
Upset	-0.0510***	-0.0438***	-0.0211	0.0045
Jittery	-0.0071***	-0.0056***	-0.0039	-0.0003
Nervous	-0.0086***	-0.0083***	-0.0060**	-0.0016
Heart Race	-0.0181***	-0.0174***	-0.0108***	-0.0042
Disabilities/Illnesses	-0.0444***	-0.0391***	-0.0051	-0.0103
Inadequate BMI	-0.0560***	-0.0671***	-0.0439	-0.0453
Smoker	-0.0636***	-0.0638***	-0.0643***	-0.0580***
Hazardous Drinking	0.0328**	-0.0053	-0.0163	0.0248

Note: Significance level – *** 1%; ** 5%; * 10%.
Source: Author's own calculations using the National Child Development Study, sweeps 0-8.