Does Ignorant Bliss exist?

An economic study into education and happiness and the differing effects for males, females and married individuals.

University ID: 0708758

Word Count: 5,044[1]

ABSTRACT

This paper documents how education affects happiness and how this varies by gender and marital status, using the National Child Development Survey. The results indicate that married females increase their chances of being very happy in life by having high levels of education. However, 'ignorant bliss'[2] is found to exist in men (independent of marital status) and in unmarried females. Individuals with CSEs or A Levels as their highest qualification are most likely to be unhappy, as completing education at this level is found to be universally detrimental to happiness. These findings raise the warning that the recent decision to increase the school leaving age to 18 will need careful thought to avoid having damaging effects on the happiness of society.

[1] Excluding tables, appendices and footnotes

[2] For the purposes of this paper, 'ignorant bliss' refers to a state of happiness that individuals with no formal qualifications may experience

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Acknowledgements: Vincent O'Sullivan, Dr Gianna Boero

Section I: Introduction

The March 2010 budget announced that government expenditure on education will rise to £89billion[3] next year. This increase of £21billion since the last general election in 2005, combined with the school leaving age set to rise to 18 by 2015, shows the Labour government's commitment to education. These policies, stemming from Tony Blair's 'Education, Education, Education' speech (1997), aim to increase the level of education of society. According to the OECD[4], the 'long term effect on economic output for one additional year of education…is between 3-6%' (2006, p27). Although the economic gains to society of having high levels of education are well documented, the effect on individuals is less clear, evoking important questions as to the effect of raising the school leaving age to 18.

Education is an important determinant of an individual's life outcomes, such as income, where they live and their occupational attainment. As a result, education has the ability to have large and heterogeneous effects on happiness. This paper seeks to determine whether education has the capability to increase happiness, and establish whether this varies depending on characteristics such as gender and marital status.

To investigate the role of education on happiness, an ordered probit model is used due to the categorical nature of the response to happiness questions. A fresh perspective is offered by separating the analysis by gender, marital status and by using the National Child Development Survey (NCDS). Furthermore, an improved empirical strategy enables this paper to be the first to calculate marginal effects on each level of education.

The results offer some confirmation of Gardner and Oswald's (2002) findings that individuals with no formal qualifications have the highest level of self reported life satisfaction. This contests David Cameron's belief 'that education is one of the keys to happiness.' (Wheeler, 2005) However, interestingly, this paper finds evidence that

[3] HM Treasury, 'Budget 2010'
[4] Organisation for Economic Cooperation and Development

more education increases the probability of being completely satisfied in life for married females. This paper concludes with a discussion of what the results imply for education policy in the United Kingdom. (See Appendix 1 for a glossary of the UK education system.)

Section II: Literature Review

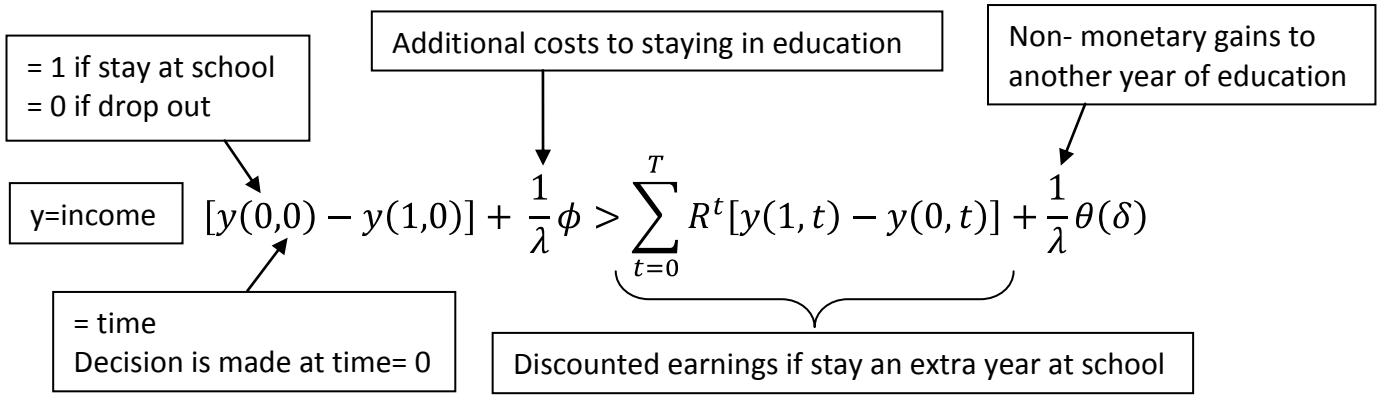
The existing literature is divided into theoretical and empirical contributions with contesting views as to the optimum level of education to maximise happiness. The terms ‘‘happiness’, ‘utility’, ‘well-being’, ‘life satisfaction’ and ‘welfare’’ (2003, p11176) will be used interchangeably throughout this paper, in the same manner as Easterlin (2003).

Theory

Theoretical arguments focus on decision-making theory and rationality to explain how people make the judgement of how much education to undergo to maximise their utility. This branch of behavioural economics also uses ideas from psychology with the two fields becoming increasingly interlinked.

Expected Utility Theory:

Economists use expected utility theory to show how rational individuals decide whether to remain in education, by assessing the trade-off between expected utility of another year of education and the associated cost (e.g. tuition fees and disutility from remaining in education). Oreopoulis creates a model to demonstrate the choice of whether to stay on at school for an extra year: (2007, p2215)



This implies an individual prefers to drop out of education if foregone earnings and additional costs (including non-monetary costs) related to staying in education are greater than the present value earnings gained from more education and non-pecuniary benefits.

Oreopoulis concludes an extra year of compulsory schooling 'increases the likelihood of being overall satisfied with life by 5.2%.' (p2223) However, this paper refers only to the decision of whether to leave school at 15 with no qualifications or to stay until 16 and gain formal qualifications. The school leaving age was last raised in 1972 to 16 (See Appendix 2 for a history of the school leaving age). Therefore, this paper is of limited use when analysing the NCDS cohort members who would have been legally required to stay on until 16. However, individuals face a similar choice when deciding whether to carry on in education at any age. Rational utility maximisers will stay in education if the expected utility is greater than stopping education at their current level. This implies 'those with more education are happier than those with less' (Easterlin, 2003, p11180) because they made the choice to undergo more education. This fits with the economists view that 'more is better' (ibid, p11176).

Satisficing Theory:

An alternative decision-making theory prominent in psychology is Simon's 'satisficing[5]' theory. 'Modern behavioural economics has acknowledged that the assumption of complete information that characterises rational choice theory is implausible.' (Schwartz et al, 2002, p1178) Therefore, in choice situations, 'people "satisfice" rather than optimise when they make decisions.' (Plous, 1993, p95) This is achieved through having a threshold of acceptability, which if a choice is seen to exceed, it will be chosen, even if the choice may not be optimal. For example, if an individual decides to leave education at 16 and start working, they may just be satisficing their immediate want/need for money. The optimal decision in the long run may have been to remain in education to increase opportunities for happiness.

[5] A portmanteau of satisfy and suffice

Decision Costs:

Prevalent in the theory is the concept that costs exist, associated to making decisions, which can lead to disutility. Not only is there the choice of which level of education to have, but education is also seen as a mechanism for increasing the choices available to an individual. People with high levels of education have more decisions to make.

Ferrante (2008) introduces the concept of 'psychological decision costs' (p2) which are bad for experienced utility. Psychological decision costs are defined as the negative aspects of having the responsibility of making a decision. They exist due to the problem of gaining information about the options available, rising standards as to what is an acceptable outcome and self punishment if a wrong choice is made. (Schwartz et al, 2002) Experienced utility 'refers to the hedonic experience associated with an outcome.' (Kahneman and Thaler, 2005, p2) This is the view that education increases actual and perceived socio-economic opportunities, but increased aspirations lead to 'systematic frustration of expectations.' (Ferrante, 2008, p5) Having more choices by undertaking more education may lead to high expectations that will not be reached, or Schwartz (2000) suggests self punishment will arise if the wrong choice is made. An optimal level of education could exist, which if exceeded, would lead to a fall in satisfaction as expectations and decision costs are too high. 'The more options there are, the more likely one will make a non-optimal choice' (Schwartz et al, 2002, p1179) and as people with higher levels of education have more options, decision costs could prevent them from being happy.

Regret Theory:

Regret theory is based on counterfactual reasoning of self-punishment if the wrong choice is made. Sarver (2005) uses menu choices to show that regret is experienced if the choice is ex-post inferior and concludes that having fewer options may increase happiness. This would support the idea that individuals with no qualifications have the highest chance of being happy as they have fewer options available, leading to fewer decisions and less regret.

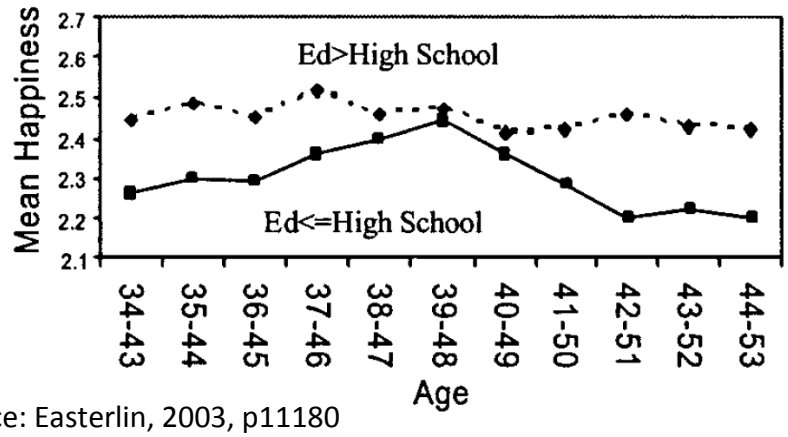
Link between education and employment:

Economists see education as a stepping stone to getting a 'good'[6] job. Spence's (1973) job market signalling model shows that employees signal their ability by investing in further education. This implies education is a means of getting a better job with a favourable contract and high pay. Fabra and Camison find that 'people with higher levels of formal education are more satisfied with their jobs,' (2009, p600) which may lead to overall life satisfaction.

Empirical Studies

The empirical evidence of the relationship between education and happiness is currently not extensive or conclusive. Witter et al found that 'education is significantly positively related to adult subjective well-being, accounting for 1-3% of the variance' (1984, p169) in happiness. Easterlin used the General Social Survey to construct Graph 1 to show a 'happiness differential by education persists' (2003, p11181) at every age, which supports the view that more education is better.

Graph 1: Mean Happiness, Cohort of 1941-1950 by level of Education and Age



Happiness is scored on a scale of 1-4 with 4 being 'very happy'

Source: Easterlin, 2003, p11180

This is in contrast with Gardner and Oswald's results (2002) using the British Household Panel Survey, where the highest levels of satisfaction were found to exist amongst those individuals with no formal qualifications. This suggests a state of ignorant bliss does exist. The concept that more knowledge is not necessarily advantageous has been found to exist in bird watching. Applegate and Clark (1987)

[6] A 'good' job is subjective, but the implication here is that the job requires someone with high ability and that an employer will be prepared to pay them more as a result.

found that bird watchers who have little knowledge of birds get more satisfaction from it than those who are bird experts.

In Oswald's later paper with Blanchflower and Landeghem (2008), a negative relationship with life satisfaction was once again found for individuals with a degree. This paper used the NCDS where it examined the effect of obesity on happiness, where education level was used as a control. However, the methodology is questionable in both of these papers as Ordinary Least Squares (OLS) has been used, failing to account for the ordered nature of the dependent variable. Estimating the model using Maximum Likelihood Estimation (MLE) using an ordered probit model would have been more appropriate. Although, Oswald and Gardner did use an ordered probit in 2002, they didn't calculate the marginal effects which means the true impact of education on happiness is not reported. Appendix 4 summarises the main findings from the empirical studies discussed above.

Section III: Data Description

Data Source

The data source for this paper is the National Child Development Survey (NCDS). The NCDS is a continuing longitudinal study which follows the approximate 17,000 individuals born between the 3rd and 9th March 1958. The NCDS is appropriate because it includes detailed information about education, happiness, demographics and expectations of life satisfaction in the future. Access to the data has been granted by data-archive. Appendix 3 details the 8 waves of the study so far with year and age of cohort members.

All waves were merged and the cohort members with missing values for salary, education and happiness were dropped leaving a sample size of 4,716. Dearden, Machin and Reed (1997) found that the attrition rate for the NCDS was highest amongst those with low ability and low levels of education. This may cause bias if individuals of low ability and low education levels are underrepresented. However,

Graph 2 shows the distribution of education levels, where it can be seen that there are sufficient individuals with each level of education (AS Level will be merged with A Level) to undergo analysis.

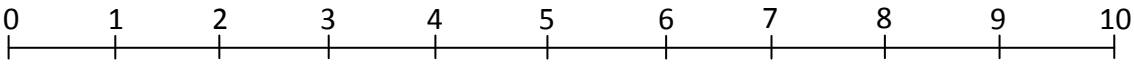
The decision to use life satisfaction and education variables from the 6th wave in 2000 was based on the availability and suitability of variables required for the study. For example, in waves before 2000, life satisfaction was on a scale of 1-4 with 1 being very happy and over 90% of the sample scoring themselves 1 or 2. With such little differentiation, it would be hard to do any meaningful analysis, making the scale of 0-10 used in wave 6 more appropriate.

Data Analysis

Dependent Variable: Life Satisfaction

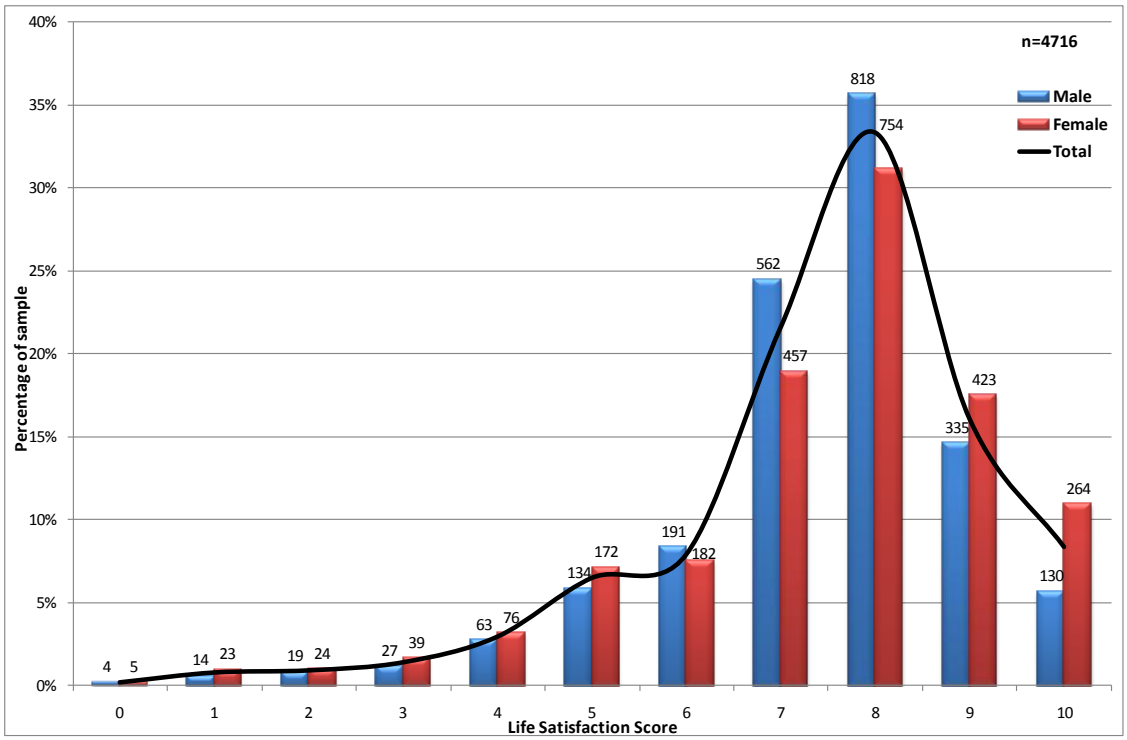
Life satisfaction is the happiness measure which will be used as the dependent variable. The relevant question from the NCDS, 2000 was:

'Here is a scale from 0-10 where '0' means that you are completely dissatisfied and '10' means that you are completely satisfied. Please enter the number which corresponds with how satisfied or dissatisfied you are about the way your life has turned out so far.' (NCDS 2000 Questionnaire, p211)



The results of this question are shown in Graph 2, where only 6.2% (292) of the sample reported life satisfaction scores below 5. Females were slightly happier than males with 9.2% (222) more females in the top 2 categories of happiness, supporting previous work (including Oswald in 2006) that on average, females are happier than males.

Graph 2: Life Satisfaction by Gender



Explanatory Variables

Table 2 presents the summary statistics for the sample. Removing the missing salary values, results in the analysis looking at working individuals only. The top and bottom 2% of salary values were dropped and the salary variable was later divided by 1000 so that the interpretation is in terms of how an extra £1000 affects happiness.

Table 2: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Life Satisfaction	4716	7.45	1.72	0	10
Academic Qualifications	4716			0	8
Annual Salary	4716	£ 19,498	£ 13,528	£ 1,500	£ 88,816

The highest level of education achieved by the cohort members is shown in Graph 3, separated by gender. 41.2% of females left education having achieved O Levels in the year 1974. Males had, on average, a higher level of education as 2.0% (47) more males achieved a degree.

Graph 3: Education Level by Gender

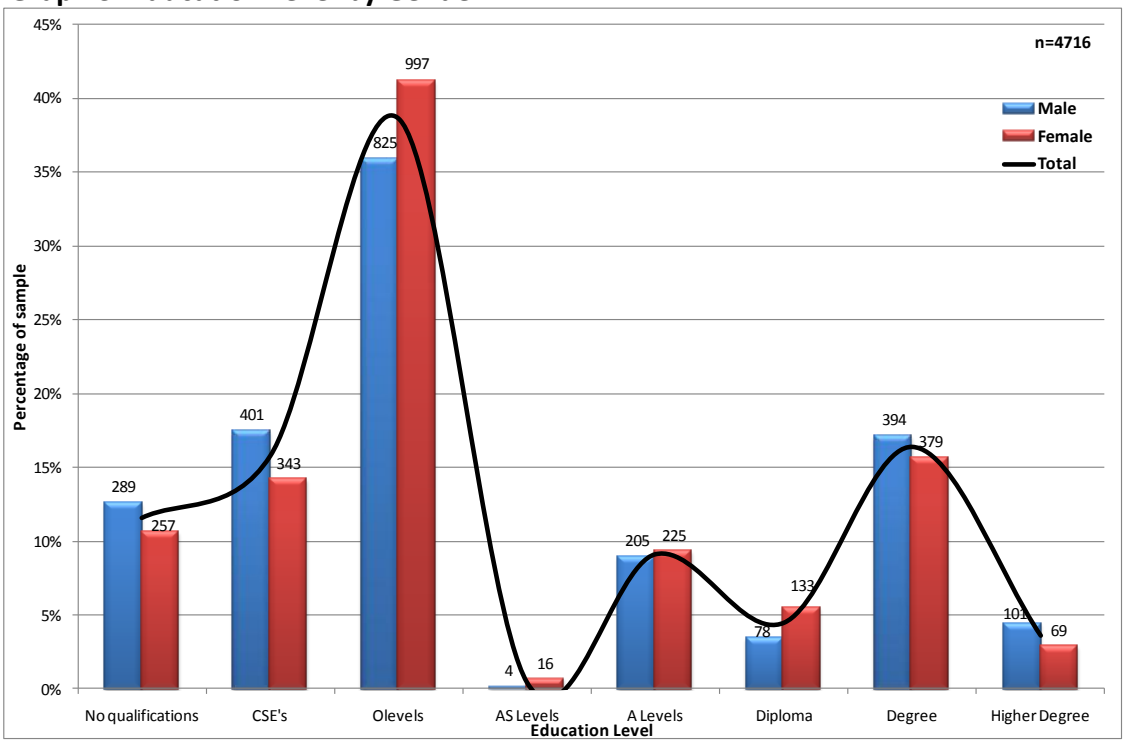


Table 3 shows the characteristics of the dataset, where it can be seen that 48.7% of the sample are male and that ethnicity related analysis will not be possible with 98.3% of the sample being white. See Appendix 5 for variable definitions.

Table 3: Data Characteristics

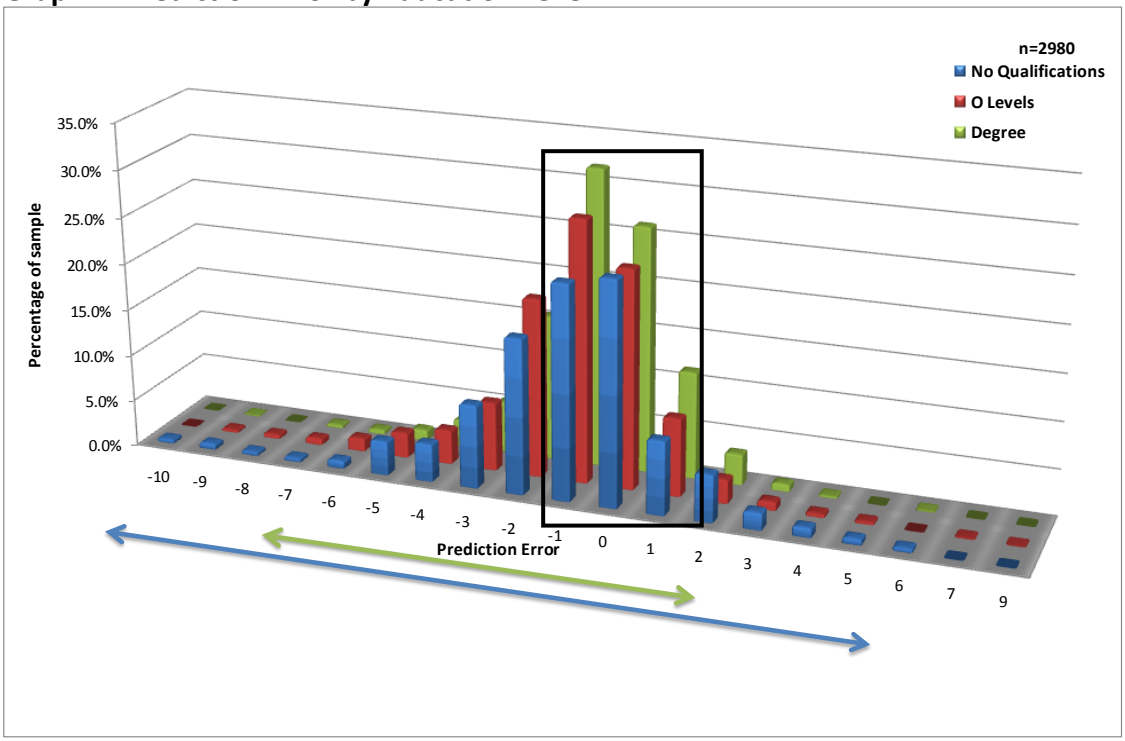
Dummy Variables	Number of observations when dummy=1	% of sample
Female	2419	51.3
Married	3503	74.3
Non-White	79	1.7
Children	3245	68.8
Health limits activity	316	6.7
Victim	662	14.0
Mortgage	3818	81.0
Renting	427	9.1
Depressed	261	5.5

As the NCDS includes a predicted life satisfaction variable for 10 years time, this allows analysis of prediction accuracy with the formulation of a 'prediction error' variable as below:

$$\text{Prediction Error} = \underset{\text{taken from 2000}}{\text{Life Satisfaction}} - \underset{\text{taken from 1991}}{\text{Predicted life satisfaction in 10 years}}$$

If prediction error<0, the individual was too optimistic with their prediction
If prediction error>0, the individual was too pessimistic with their prediction

Graph 4: Prediction Error by Education Level

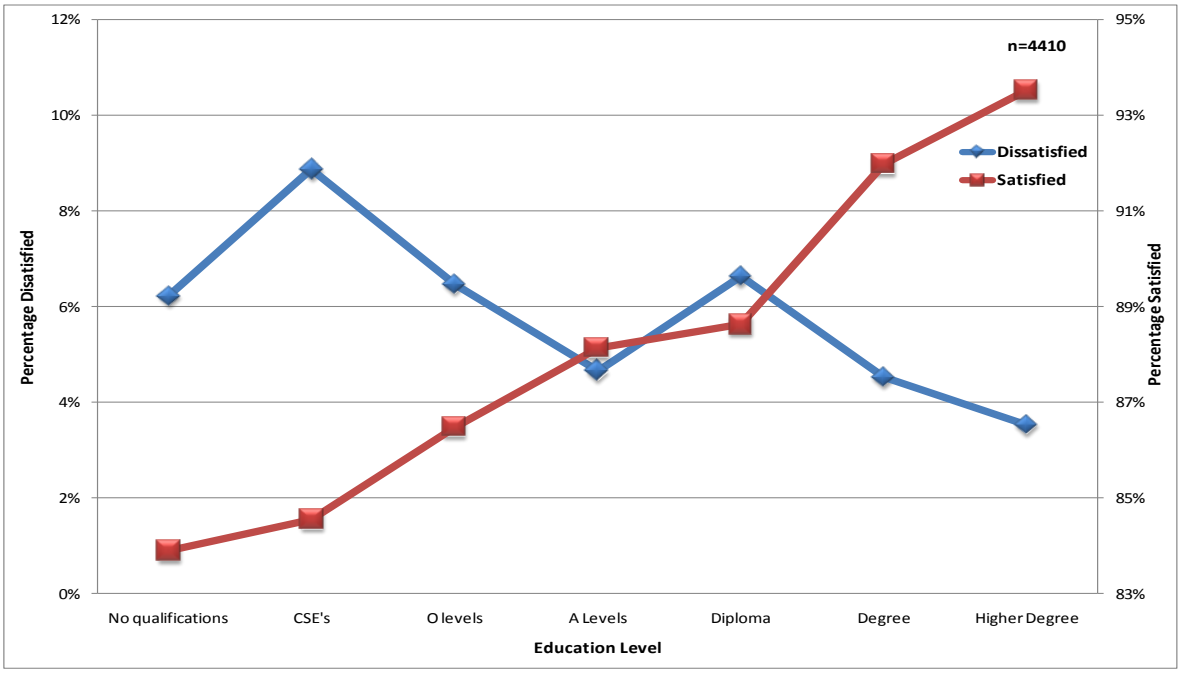


Graph 4 shows that education brings a sense of realism, as people with higher levels of education are better at predicting their actual level of happiness[7]. Within the band of -1 to +1, it can be clearly seen that as education level increases, the percentage of people who have accurately predicted their happiness also increases. The arrows show that the range of non-zero values for individuals with no qualifications is much larger compared to individuals with a degree. This would suggest that people with higher levels of education are better at managing their own happiness by achieving the happiness level they predict.

A preliminary assessment of the relationship between education and happiness is shown in Graph 5 (See Appendix 7 for accompanying table), suggesting that individuals with more education are happier. To create this graph, life satisfaction scores were grouped into scores below 5 (dissatisfied) and scores above 5 (satisfied). Of the individuals with no qualifications, the lowest percentage were satisfied with life and of the individuals with a higher degree, the highest percentage were satisfied with life.

[7] This trend is the same for all levels of education but for the benefit of clarity just 3 education levels are shown.

Graph 5: Percentage of Dissatisfied and Satisfied individuals by Education level



The upward slope of the satisfied graph supports the hypothesis that education increases happiness and the trend is further supported by the dissatisfied trend line, although there are slight discrepancies for no qualifications and higher qualifications. This preliminary trend contradicts Gardner and Oswald's findings in 2002 that people with no qualifications were most satisfied. However, grouping all individuals with life satisfaction scores above 6 together results in a loss of meaning as people who gave themselves 6 are clearly not as happy as those who gave themselves 10. As a result, this graph may not be explaining the true effect of education on happiness, necessitating the use of an ordered probit model to enable the separation of the effect of education for each level of happiness.

Section IV: Methodology

A concern with the existing literature is that the empirical strategy has been oversimplified by assuming that life satisfaction is a continuous variable. As a result, this paper addresses this empirical issue by using an ordered probit model, and calculating the marginal effects of education on happiness.

To ease the interpretation of the model, the dependent variable was re-categorised into 5 outcomes outlined in Table 4. These boundaries are rationalised by looking at Graph 2 and observing that so few individuals scored themselves less than 5.

Table 4: Life Satisfaction Variable

Old rating /10	New rating	Explanation
0-4	1	Unsatisfied
5-6	2	Neither satisfied nor dissatisfied
7	3	Satisfied
8	4	Very satisfied
9-10	5	Completely satisfied

The life satisfaction variable has a logical ordered response, using a scale of 1-5 for satisfaction. This makes it appropriate to use an ordered probit model, which uses Maximum Likelihood Estimation (MLE). The model is based on a single underlying unobserved variable (y_i^*), which is a linear combination of some explanatory variables (x), plus an error term that has a standard normal distribution.

$$y_i^* = x_i\beta + \varepsilon_i \qquad \text{where } \varepsilon_i \sim Normal\ (0,1)$$

(Note that Stata[8] does not include an intercept)

The model for binary outcomes is expanded to divide y* into j ordinal categories where j is the ordinal response:

$$y_i = j\ if\ \mu_{j-1} < y_i^* \leq \mu_j \qquad \text{for j = 1 to 5}$$

(Note that the cutpoints (μ_j) will be estimated by Stata)

See Appendix 6 for a more detailed explanation of an ordered probit model.

Six different equations were estimated; where the first just included each education level, leaving no qualifications as the default case:

Model 1[9]:

$$life\ satisfaction = \beta_1 CSE + \beta_2 Olevels + \beta_3 Alevels + \beta_4 Diploma + \beta_5 Degree + \beta_6 Higherdeg + \varepsilon$$

[8] Stata is the statistical software package used throughout this project to conduct statistical analysis

[9] Numbers refer to the equations used in the results Table 5

Controls were subsequently added to assess how the specific effect of education changes when the potential of omitted variable bias is reduced.

For example, Model 5:

$$life\ satisfaction = \beta_1 CSE + \beta_1 Olevels + \beta_2 Alevels + \beta_3 Diploma + \beta_4 Degree + \beta_5 Higherdegree + \beta_6 female + \beta_{13} female \times CSE + \beta_{14} female \times O\ level + \beta_{16} female \times Alevel + \beta_{17} female \times Diploma + \beta_{18} female \times Degree + \beta_{19} female \times higherdegree + \beta_7 salary/10^3 + \beta_8 nonwhite + \beta_9 victim + \beta_{10} badhealth + \beta_{11} married + \beta_{12} children + \beta_{13} X + \varepsilon$$

Where X is a vector of region dummies

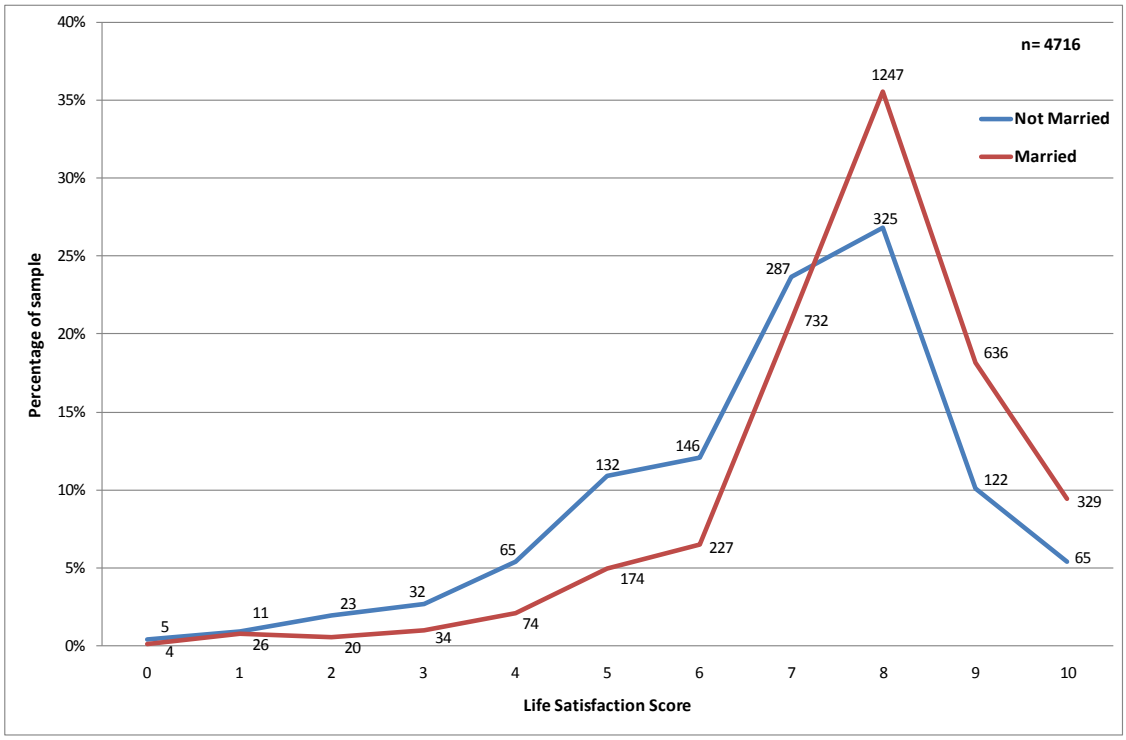
Furthermore, as an extension to the current literature, the model was then separated for males and females by marital status to assess how the effect of education on happiness varies for these different groups of people.

Endogeneity

Previously, the possibility of an endogeneity bias has been ignored. However, endogeneity could exist if highest education level achieved and happiness are correlated with some unmeasured causal factors. For example, achieving high levels of education is less likely to occur if you come from a challenging family background; where your parents may have divorced, you were living in relative poverty or your parents didn't actively encourage education. As these factors could also make an individual less likely to be happy, endogeneity could be present. See Appendix 8 for a more detailed explanation of endogeneity bias.

Furthermore, including a marriage dummy variable could lead to an endogeneity bias as people wouldn't necessarily stay married if it was making them unhappy. The correlation between marriage and life satisfaction is 0.205 with Graph 6 confirming that married individuals are more likely to be happy. It is worth noting that not married individuals include individuals who are single, divorced, separated, cohabiting and widowed.

Graph 6: Happiness Levels for Married and Not Married Individuals



To overcome endogeneity bias, an Instrumental Variable (IV) model could be used, using 'two stage least squares' and suitable instruments. However, it is difficult to address the problem of endogeneity in the ordered probit estimation (other than adding control variables). IV estimation would require either a binary probit approach by creating a 'happy' dummy dependent variable or by using OLS. Therefore, a lack of suitable instruments, combined with the desire to not oversimplify the model, has resulted in there being no IV analysis carried out. Instead, there will be an appreciation of where an endogeneity bias may be influencing results and a recommendation that future work should look into performing IV analysis.

Section V: Results and Analysis

This section explores how education affects happiness using an ordered probit model estimated using MLE. Table 5 presents the marginal effects on output 5 from the corresponding ordered probit models for six different model specifications. Firstly, the focus is on output 5 so that the level of education which maximises individuals' chance of being completely satisfied can be determined.

As the coefficients reported by Stata can only be interpreted in relative terms[10] and cannot show which education level increases the probability of being in each life satisfaction score category, they have not been reported. See Appendix 9 for the Stata output for model 1. Instead, the marginal effects are reported. McFadden's pseudo R^2 is stated for the relevant model, but this has very low power. An alternative is the percentage of observations correctly predicted, which looks at how well the model predicts the observations in each life satisfaction category. (See Appendix 10 for full explanation of the calculation and see Appendix 11 for the percentage of observations correctly predicted for each model estimated.) From Appendix 11, it can be noted that model 1-6 are relatively good at correctly predicting the life satisfaction scores of 3, 4 and 5 but do not accurately predict the life satisfaction scores of 1 and 2.

The marginal effects for model 1 appear to suggest that education has very low explanatory power for happiness, as only the marginal effect on CSE is significant[11]. This marginal effect is interpreted as having CSEs as your highest qualification reduces the probability of you being completely satisfied by 3.9 percentage points, compared to someone with no qualifications.

[10] i.e if the coefficient on diploma is larger than the coefficient on A Level, then this is interpreted as having a diploma increases your chance of being happy.

[11] Throughout the results section, the term "significant" refers to statistical significance i.e. a coefficient is statistically significant from zero.

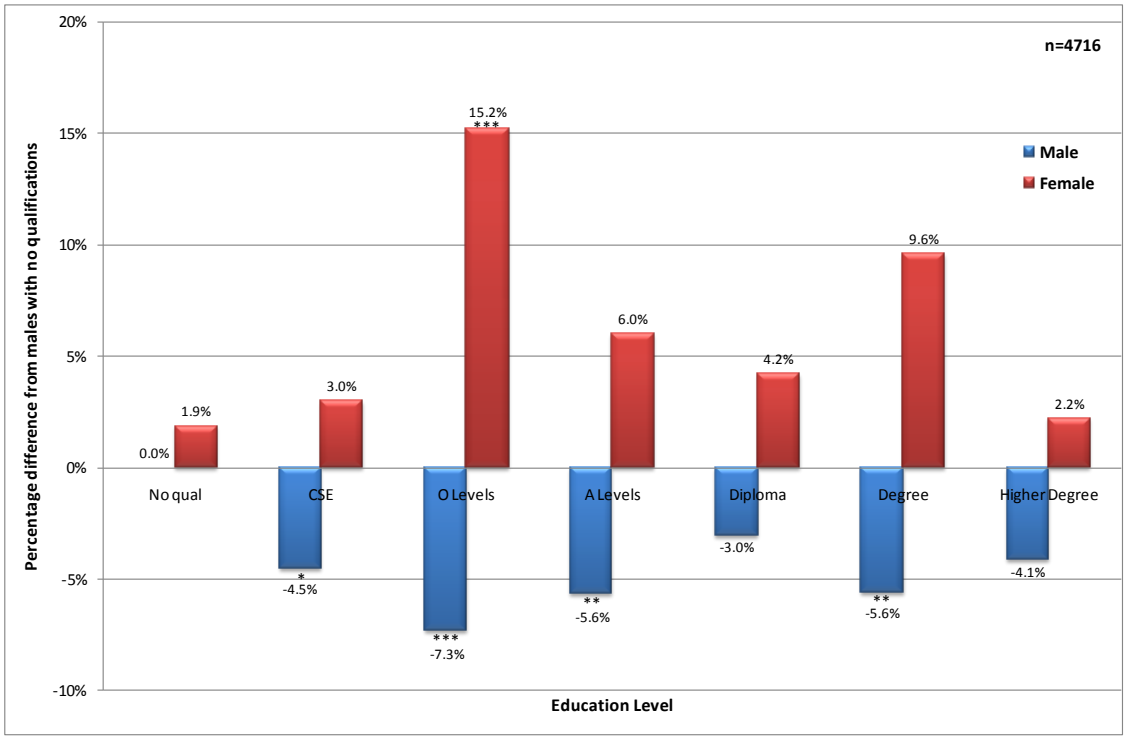
Table 5: Ordered Probit Marginal Effects

n=4716	Marginal Effects on Output '5' (Rating of 9 or 10 on life satisfaction scale)					
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CSE	-0.039 **	-0.041 **	-0.038	-0.042 *	-0.045 *	-0.111***
	(0.018)	(0.018)	(0.024)	(0.023)	(0.023)	(0.031)
O Level	-0.009	**-0.017**	**-0.056** **	-0.070 ***	-0.073 ***	-0.120***
	(0.016)	(0.016)	(0.022)	(0.022)	(0.021)	(0.032)
A Level	-0.020	-0.026	-0.020	-0.053 *	-0.056 **	-0.094**
	(0.021)	(0.020)	(0.029)	(0.027)	(0.027)	(0.036)
Diploma	0.012	0.003	-0.011	-0.032	-0.030	-0.090*
	(0.028)	(0.027)	(0.041)	(0.039)	(0.039)	(0.047)
Degree	0.005	-0.0001	-0.016	-0.053 **	-0.056 **	-0.107***
	(0.019)	(0.019)	(0.025)	(0.024)	(0.024)	(0.032)
Higher Degree	0.033	0.033	0.002	-0.040	-0.041	-0.092*
reference category: No qualifications	(0.031)	(0.031)	(0.038)	(0.035)	(0.035)	(0.047)
Female		0.032 ***	-0.007	0.022	0.019	0.018
		(0.010)	(0.028)	(0.029)	(0.028)	(0.028)
Female, CSE			-0.007	-0.004	0.004	0.006
			(0.037)	(0.037)	(0.037)	(0.037)
Female, O Level			**0.082** **	0.090 **	0.098 ***	0.098***
			(0.035)	(0.036)	(0.036)	(0.036)
Female, A Level			-0.006	0.009	0.022	0.023
			(0.042)	(0.043)	(0.044)	(0.044)
Female, Diploma			0.035	0.038	0.031	0.028
			(0.059)	(0.059)	(0.058)	(0.058)
Female, Degree			0.037	0.045	0.059	0.061
			(0.039)	(0.040)	(0.040)	(0.040)
Female, Higher degree			0.073	0.067	0.075	0.077
reference category: Female, No quals			(0.067)	(0.067)	(0.067)	(0.067)
Annual Salary /10^3				0.003 ***	0.003 ***	0.003***
				(0.0005)	(0.0005)	(0.0005)
Married					0.140 ***	0.081***
reference category: Other marital statuses					(0.010)	(0.028)
Married, CSE						0.114**
						(0.048)
Married, O Level						0.071*
						(0.038)
Married, A Level						0.067
						(0.053)
Married, Diploma						0.107
						(0.073)
Married, Degree						0.087*
						(0.046)
Married, Higher degree						0.091
reference category: Married, No quals						(0.075)
Controls:						
Bad health	No	Yes ***	Yes ***	Yes ***	Yes **	Yes ***
Victim	No	Yes ***	Yes ***	Yes **	Yes ***	Yes **
Children	No	Yes ***	Yes ***	Yes ***	Yes	Yes
Regions	No	Yes	Yes	Yes	Yes	Yes
Model:						
Pseudo R^2	0.0009	0.0066	0.0077	0.0103	0.0223	0.0228
Log-likelihood	-7037.7	-6997.1	-6989.9	-6971.4	-6886.6	-6883.0
Prob>chi^2	0.055	0.000	0.000	0.000	0.000	0.000
% of obs correctly predicted	79.4%	73.1%	72.5%	72.9%	74.0%	73.9%

Standard Errors in parentheses **Stars represent significance levels: *** p<0.01, ** p<0.05, * p<0.1**

The addition of female interactive terms (Equation 3), show the differing effect of O Levels by gender; the marginal effect becomes significant and negative for males, but positive and significant for females. However, the use of interactive dummy variables in models 3 and 6 confuse the interpretation, as for example, the marginal effect on CSE in model 6 refers to an unmarried male. Therefore, a way to enable the comparison of males and females to the same default case is to calculate the difference of differences. This has been calculated using model 5, with the same default case of males with no qualifications for each level of education. (See Appendix 12 for full explanation)

Graph 7: Difference of Differences for output 5 for Males and Females



Graph 7 shows that women are happier than men at every level of education and that ignorant bliss exists for men as they maximise their chances of happiness by having no qualifications. The gender differential is at its greatest when O Levels are the highest qualification.

Since the results indicate that the effect of education on happiness differ by gender (Equation 3, 4, 5) and marital status, (Equation 6) the models are estimated

separately for married females, unmarried females, married males and unmarried males.

Females

For married females, Table 8 presents some evidence of a positive and significant relationship between education and happiness. Significant results are found for married females with O Levels, a degree and a higher degree, where the effect amplifies as education level increases. A married female with a higher degree is 12.9 percentage points more likely to be completely satisfied than a married female with no qualifications.

Table 8: Married and Unmarried Females

	Marginal Effects on Output '5'			
	Married Females		Unmarried Females	
Variables	(7)	(8)	(9)	(10)
CSE	-0.014	-0.006	-0.082 **	-0.099 ***
	(0.037)	(0.038)	(0.032)	(0.029)
O Level	0.054 *	0.061 *	-0.019	-0.056
	(0.032)	(0.032)	(0.035)	(0.034)
A Level	-0.021	-0.015	-0.018	-0.068 *
	(0.040)	(0.041)	(0.043)	(0.036)
Higher qualifications	0.046	0.057	-0.037	-0.084 **
	(0.049)	(0.050)	(0.053)	(0.040)
Degree	0.067 *	0.079 **	-0.036	-0.073 **
	(0.039)	(0.039)	(0.037)	(0.034)
Higher Degree	0.107	0.129 *	0.015	-0.057
	(0.068)	(0.069)	(0.071)	(0.054)
Reference category: No qualifications				
Controls:				
Non-white	No	Yes *	No	Yes ***
Victim	No	Yes ***	No	Yes *
Regions	No	Yes *	No	Yes
Bad health	No	Yes **	No	Yes
Children	No	Yes	No	No
Tenure	No	No	No	Yes ***
Salary	No	No	No	Yes *
Model:				
Observations	1767	1767	652	652
Pseudo R^2	0.0028	0.0075	0.0037	0.0226
Log-likelihood	-2536.3	-2524.2	-1023.3	-1003.8
Prob>chi^2	0.029	0.009	0.274	0.002
% of obs correctly predicted	57.8%	59.4%	73.6%	73.7%

There may be a problem of endogeneity when looking at marriage, if marriage is a function of happiness. In a country where divorce is relatively straightforward, individuals tend not to remain married if they are unhappy. Therefore, this may be why in model 5 and 6 the marginal effects on the marriage dummy variable are large. However, this doesn't explain the marginal effects from model 8, where the chance of being happy increases with education level, as the model only includes married females.

The results for unmarried females are a stark contrast to married females as ignorant bliss appears to exist, with evidence that qualifications reduce happiness. CSEs have the largest detrimental effect, which is significant at the 1% level, by reducing the chance of being completely satisfied by 9.8 percentage points.

Males

Table 9 shows that ignorant bliss exists for males independent of marital status.

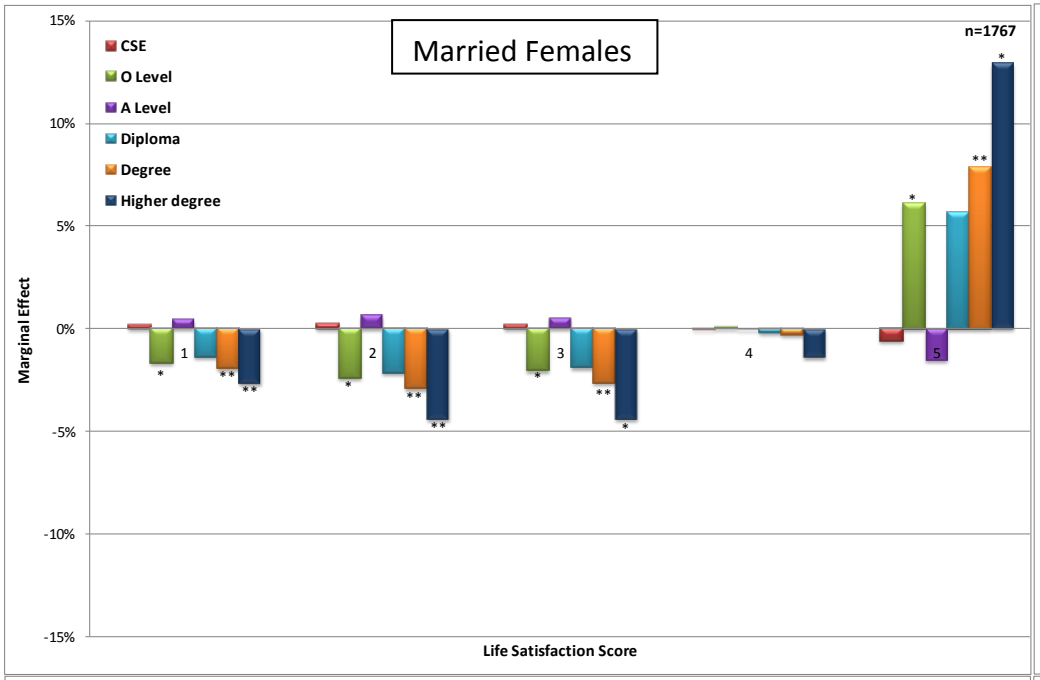
Table 9: Married and Unmarried Males

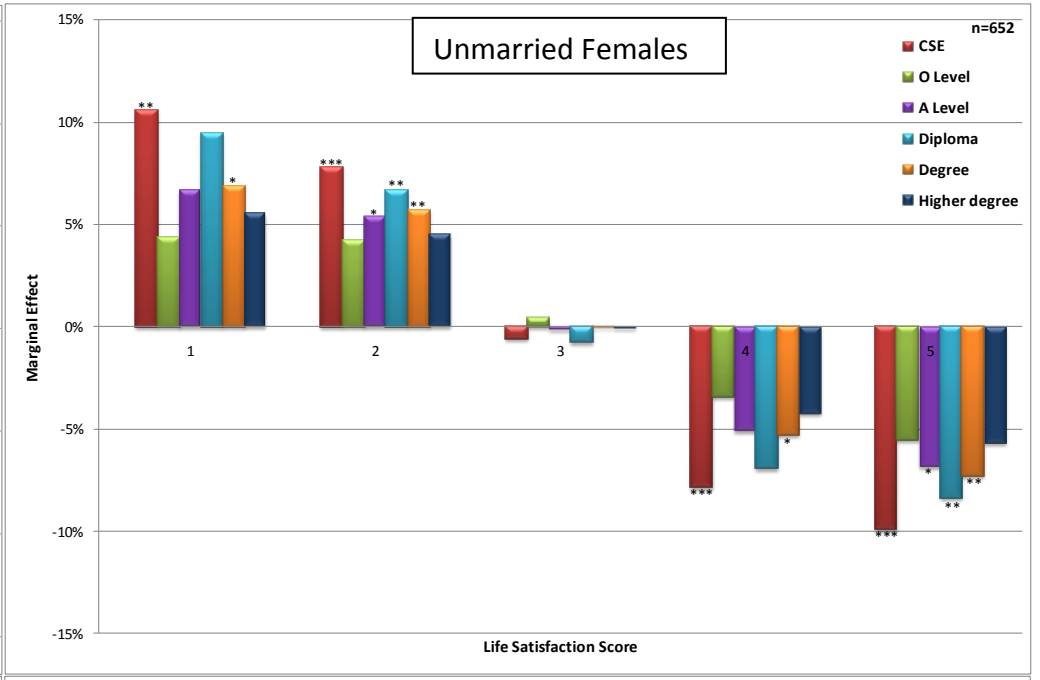
	Marginal Effects on Output '5'			
	Married Males		Unmarried Males	
Variables:	(11)	(12)	(13)	(14)
CSE	-0.017	-0.027	-0.069 ***	-0.080 ***
	(0.028)	(0.027)	(0.025)	(0.024)
O Level	-0.044 *	-0.065 ***	-0.064 **	-0.078 ***
	(0.025)	(0.024)	(0.027)	(0.027)
A Level	0.013	-0.033	-0.070 **	-0.084 ***
	(0.034)	(0.032)	(0.027)	(0.023)
Higher qualifications	0.009	-0.016	-0.041	-0.058 *
	(0.049)	(0.046)	(0.042)	(0.035)
Degree	-0.004	-0.052 *	-0.035	-0.066 **
	(0.028)	(0.027)	(0.030)	(0.026)
Higher Degree	0.024	-0.029	-0.032	-0.069 **
	(0.045)	(0.040)	(0.043)	(0.031)
Reference category: No qualifications				
Controls:				
Regions	No	Yes	No	Yes
Bad health	No	Yes **	No	Yes **
Tenure	No	Yes	No	Yes
Salary	No	Yes ***	No	Yes **
Children	No	No	No	Yes
Model:				
Observations	1736	1736	561	561
Pseudo R^2	0.0018	0.0115	0.0047	0.0209
Log-likelihood	-2459.6	-2435.6	-864.6	-850.5
Prob>chi^2	0.184	0.000	0.220	0.014
% of obs correctly predicted	69.4%	66.2%	67.1%	67.5%

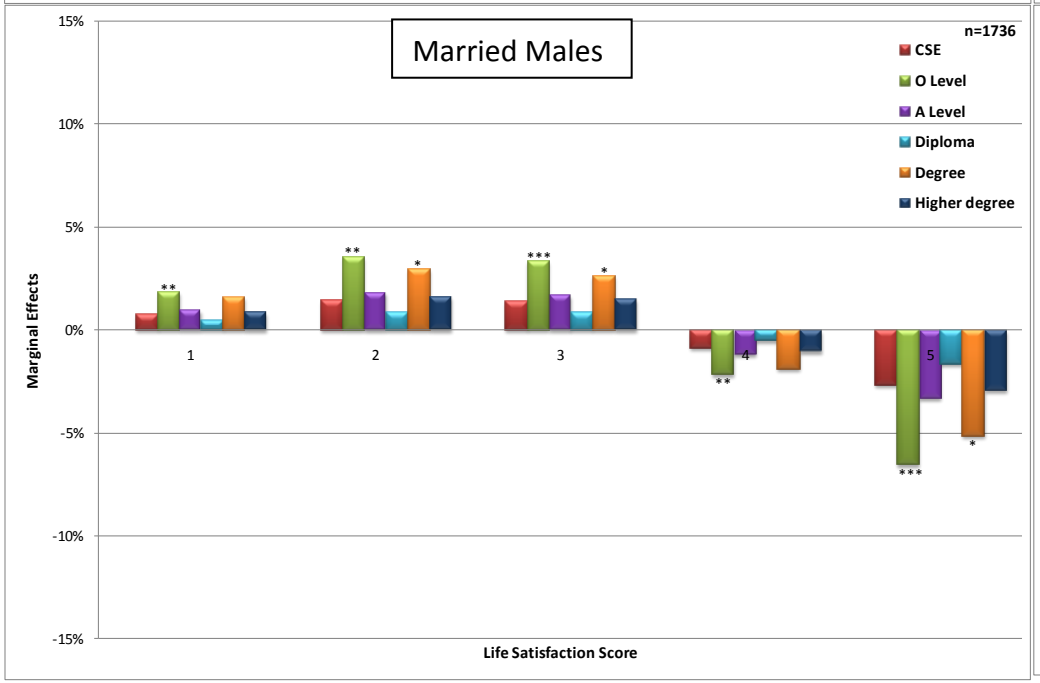
Comparison of all 4 models using Graph 8

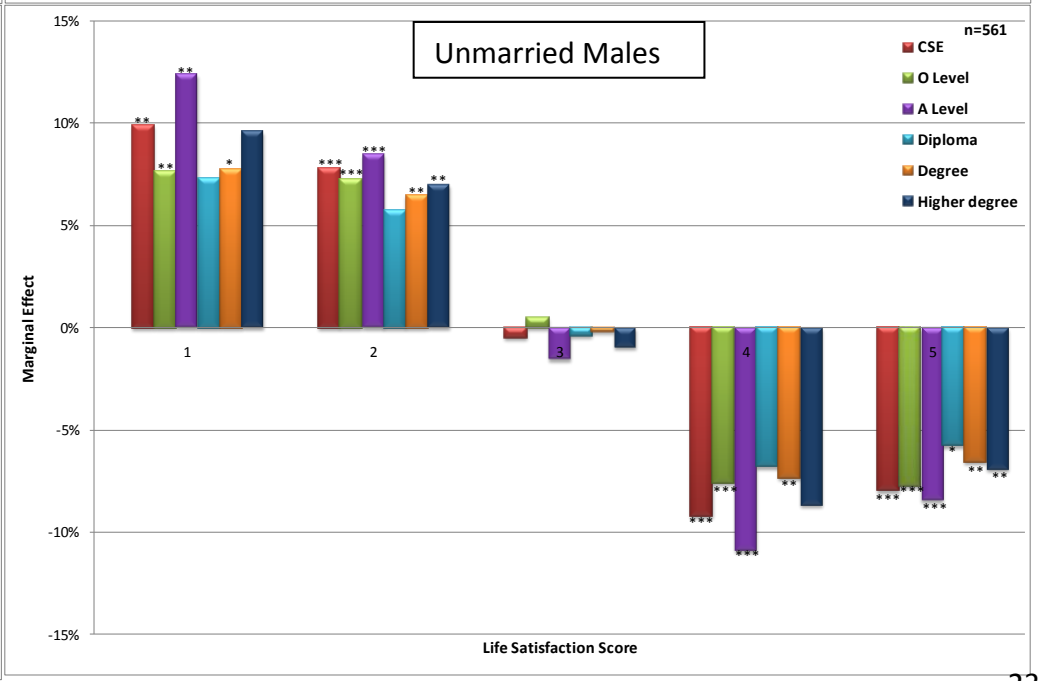
To enable a comprehensive analysis of the effect of education on happiness, it is imperative to study each happiness level, and which education level increases the chance of being in each category. To this effect, Graph 8 shows the marginal effects of education level on each happiness score for all 4 models with controls (i.e. model 8, 10, 12, and 14).

Graph 8: Marginal Effects on each Life Satisfaction score for all models









For married female's, the marginal effect is relative to a married female with no qualifications at each happiness level. Married females with a higher degree maximise their probability of being very satisfied (5) and minimise their probability of being unhappy (1). Although not statistically significant, it appears that married females maximise their probability of being unhappy by having CSEs or A levels as their highest qualification. CSEs were taken by those not deemed capable of taking O Levels. A Levels are a signalling device to Universities, thus indicating failure to attend University. These 'failure qualifications' portray a negative effect on well-being.

The unmarried females graph shows that ignorant bliss exists for unmarried females as they are most likely to be in category 4 or 5 and least likely to be in category 1 or 2. The graph further supports that CSEs have dire consequences on happiness increasing the probability that individuals are in category 1 or 2 by 10.5 and 7.8 percentage points respectively.

Analysis

How does the effect of education on happiness vary by gender and marital status?

Married females are the only group where ignorant bliss appears not to exist. Linking this evidence back to the theoretical framework outlined in Section II, there are a few hypothesises which could offer insight as to why there are gender and marital status differences.

Firstly, if psychological decision costs exist for everyone, it appears that only married females are able to overcome them. This could be because married females with high levels of education are able to discuss their choices through with their husband, formulating realistic expectations and benefitting from having the support of a spouse. However, this would suggest that males do not benefit in the same way by having a wife. This could be because women have 'the ability to communicate, cooperate, and express emotions' (Lisowska, 2007, p163) better than men. This results in men taking on the burden of decision-making themselves, which leads to decision costs reducing happiness. However, the negative effects on happiness of having qualifications are smaller for married men than for unmarried men, suggesting

they are able to benefit to some degree by having a spouse. For example, the average negative effect of having any formal qualifications reduces the probability of being completely satisfied by 3.7 percentage points on average compared to a reduction of 7.5 for unmarried males.

Regret theory posits that individuals will experience regret if a decision they made becomes ex-post inferior, leading to self-punishment. As individuals with higher levels of education have more decisions to make, they are more likely to suffer from regret. It appears that married females are able to overcome regret, perhaps because the support they get when making decisions helps them make more right decisions and enables them to cope with regret better.

Section VI: Conclusions and Extensions

Overall, ignorant bliss is found to exist for males and unmarried females. This supports previous work by Gardner and Oswald (2002) and Blanchflower et al (2008), but contradicts the work of Easterlin (2003) who found education above high school to increase happiness. Interestingly, there is evidence that education increases the chance of being happy for married females. This may be due to married females being able to overcome the psychological decision costs that coincide with higher levels of education, by using the support of their husband. However, males and unmarried females appear not to be able to overcome these decision costs. Therefore, ignorant bliss exists. To maximise the probability of being completely satisfied with life, having no qualifications is optimal. Furthermore, the worst qualifications to have as your highest are CSEs or A Levels as they have damaging effects on happiness, reducing the probability of being completely satisfied by almost 10 percentage points compared to no qualifications for both unmarried males and females.

These results have implications for the recent decision to increase the school leaving age to 18 by 2015. The increase will create a new group of students who would have previously left education at 16 after completing their GCSEs[12], but in 2015 will be required to remain in education until 18. As my results suggest that A level

[12] GCSEs and O Levels are taken to be equivalent for this analysis

qualifications have detrimental effects on happiness, increasing the number of students who take A Levels will reduce the welfare of the nation. Therefore, those who would have previously left education at 16 and those who would have left after A Levels, should be encouraged not to do A Levels under the new law to maximise their chance of happiness.

For females in this situation, re-doing GCSEs would appear the best way to spend the extra 2 years of education to minimise their chance of being unhappy. This can be seen from Graph 8 where for unmarried females, having O Levels as the highest qualification is the least bad qualification to have with the intention of maximising the chance of being happy (Life satisfaction score of 4 or 5). Similarly, O Levels reduce the probability of having low life satisfaction scores by 2.1 percentage points[13] compared to no qualifications for married females.

However, for males, the extra 2 years of schooling would be best suited to completing a diploma. Having a diploma reduces the probability of having a life satisfaction score of 1 or 2 for both married and unmarried males (compared to no qualifications) and is the qualification that makes a male most likely to be in category 4 or 5. Under the new law, more diplomas have been proposed, ensuring a policy of encouraging more males to take diplomas would be relatively easy to implement.

Therefore, to successfully implement the increase in the school leaving age, without negative effects on welfare, schools needs to encourage those not capable of achieving A Levels, or higher levels of education to do alternative qualifications after their GCSEs.

As the government continues to encourage individuals to complete more education, it has a responsibility to ensure this is not to the detriment of human welfare. Therefore, the government should look into helping individuals with the psychological decision costs associated with higher levels of education. The government could provide a service to educate individuals on how to deal with life decisions with the

[13] Average of the marginal effect on O Level for a life satisfaction score of 1 or 2

aim to minimise decision costs. However, further evidence is required that decision costs exist before the government could implement a policy to this effect.

Limitations and Extensions:

The subjective nature of happiness means that there could be many omitted relevant variables, either through lack of information (e.g. social interaction such as friendship) or through a lack of consideration, that may affect happiness. Life satisfaction is a self-reported measure in the NCDS and although there is no incentive to lie, there is certainly the possibility of immediate feelings affecting the score.

Due to data limitations, I was unable to look at the effect of over-qualification, which could be a cause of regret. If an individual is in a job which they have too many qualifications for, this could make them unhappy. Categorising jobs by the level of education required would enable over-qualified individuals to be studied in isolation.

The British data means the results are based on the British education system, thus limiting external validity. An interesting extension could be to see how education affects happiness in a country less developed than the UK, where education would have a more significant impact on the opportunities available to individuals.

There is much work still to be done on this topic, especially in the area of decision costs and other factors which may cause disutility with higher levels of education. Exploring the existence of an endogeneity bias and possible ways to overcome it is an area which requires further research. Panel data would enable future researchers to compare immediate with long-term effects of an extra level of education. As the life satisfaction score used was taken at the age of 42, this was up to 27 years since education. If a life satisfaction score could be taken before and after an education level was taken there would be the opportunity to find the causal effect of each education level on happiness.

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Data source

National Child Development Survey (NCDS): www.data-archive.ac.uk

Information about data:

Centre for Longitudinal Studies, NCDS information including Questionnaires available at: http://www.cls.ioe.ac.uk/studies.asp?section=000100020003 [accessed on 25th March]

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Appendices

Appendix 1: Glossary of Academic Qualifications in the UK

(In the order they would have been achieved)

CSE (Certificate of Secondary Education): Taken instead of O Levels at the end of compulsory schooling at age 15/16. Easier than O Levels, replaced by GCSE's in 1988

O (Ordinary) Levels: Taken at end of compulsory schooling at age 15/16. Replaced by GCSE's in 1988

GCSE's (General Certificate of Secondary Education): Taken at end of compulsory schooling. Replaced CSE's and O Level's in 1988. The cohort members of the NCDS would only have taken GCSE's if they returned to education later in life

AS (Advanced Supplementary) Levels: Taken 1 year after the end of compulsory schooling at age 16/17.

A (Advanced) Levels: Taken 2 years after the end of compulsory schooling at age 17/18 to determine entry into university.

Diploma e.g. HND's (Higher National Diploma) or HNC's (Higher National Certificate): More vocational than a degree, usually last 2 years, some require A Levels for entry, some are taken instead of A Levels. Subjects include engineering, health and social care

Degree: Awarded after usually 3 or 4 years at University or college of higher education including teaching qualifications

Higher degree: Postgraduate education such as a Masters, PhD or equivalent

Appendix 2: History of the School Leaving Age

1899: Leaving age raised to 12

1918: Full-time education compulsory up to 14

1944: Education Act raises leaving age to 15

1964: Raising of school leaving age to 16 announced, but not in place until 1972

2008: Year 7's will have to stay in education until they are 17 (in 2013)

2008: 'September Guarantee' where every school leaver is guaranteed the offer of a place in post-16 education or training

2015 (proposed): Raising of school leaving age to 18

Appendix 3: Waves of the NCDS

Wave	Year	Age
0 (PMS[14])	1958	Birth
1	1965	7
2	1969	11
3	1974	16
4	1981	23
5	1991	33
6	1999-2000	42
7	2004	46

[14] Perinatal Mortality Survey

Appendix 4: Empirical Studies

Title, Journal	Author	Sample	Method	Outcomes and controls	Effects	Comment
'How does Education affect mental well-being and job satisfaction?', National Institute of Economic and Social Research	Oswald and Gardner, 2002	British Household Panel Survey 1996-2000	OLS with robust standard errors	Dummies for O Level, A Level, HND, Degree qualifications with no formal qualifications as the omitted category. Controls for employment status, income, age, marital status and race	Highest level of life satisfaction is among those with no qualifications Lowest level of life satisfaction is amongst individuals with a degree	Methodology not explained, marginal effects not calculated, inappropriate use of OLS- ordered probit more suiTable, no instrument used for the endogeneity between stress and education level.
Explaining Happiness, National Academy of Sciences	Easterlin, 2003	General Social Survey (USA data) 1972-2002	Uses education as a proxy for income to calculate mean happiness levels for individuals with more than high school education and those with up to high school education over the life cycle	Graph of mean happiness over the life cycle as shown in Table 1	Higher education does result in a higher level of happiness no matter what age you are.	Focus of the paper is to work out if higher income increases happiness and therefore doesn't spend much time discussing the results of education on happiness
Imitative obesity and relative utility, NBER Summer Institute on Health Economics	Blanchflower, Oswald and Landeghem, 2008	National Child Development Study 1958-2005	Reports both OLS and ordered logit results for life satisfaction	Health, BMI, Education dummies, Marital status, Employment status, children.	Having a degree again has negative effects on life satisfaction, but a higher degree has a positive and significant effect for men.	NCDS is the same data set that I will be using so I am interested to see what results were achieved here although the focus was on health. Methodology and statistical methods can be improved, and IV estimation can be used to correct for endogeneity.

Appendix 5: Description of Main Variables

	Variable name	Year of Survey	Description	How measured?
Dependent variable:	lifesat1	2000	Satisfaction scale with how life has turned out so far	0-10 where 0 is completely dissatisfied and 10 is completely satisfied
Explanatory variables:				
Education variables:	hqual23	1991	Highest qualification gained at 23	e.g. O Level's, CSE's, A levels, degree
	hqual33	1991	Highest qualification gained at 33	e.g. O Level's, CSE's, A levels, degree
	nd7hachq	2004	Derived highest qualification using info from 1991, 2000, 2004	e.g. O Level's, CSE's, A levels, degree
Gender:	n622_4	1981	Gender	Male, Female
Ethnicity:	ethnic	2000	Ethnicity	e.g.: Black, Asian, White
Income (Example):	cgropay, cgroprd	2000	Current job gross pay, Current job gross pay period	£, Day, week, month, year
Job information:	econact	2000	Current employment status	e.g. Full time employed, unemployed
Parent's social class:	n2384, n2393	1969	Father's/Male head's and mothers social class	I,II, IIImanual etc
Ability:	n920	1969	Total ability tests scores	/80
Marital status:	n5113, ms	1981, 2000	Marital Status	single, married etc
Health:	malaise	1981	Malaise questionnaire combined results	Normal: 0-7 Depressed: 8-24
	n7khllt	2000	Whether health limits everyday activities	Yes/No
Children:	chd16f	2000	Children	Any children living in household yes/no
Tenure:	tenure2	2000	Does cohort member own or rent home?	Renting, own outright, mortgage, living rent free
Victim:	n7victi1,2,3,4	2000	Has cohort member been a victim of crime?	Yes/ No
Regions:	n6gor	2000	Government regions	South East, Wales, South West etc
Expectations:	n509776	1991	Life satisfaction in 10 years time	0-10 where 0 is completely dissatisfied and 10 is completely satisfied

Appendix 6: Mathematical Explanation of an Ordered Probit model

The concept with an ordered probit model is that there is a latent continuous variable underlying the ordinal responses reported for life satisfaction. The latent continuous variable (y*) is a linear combination of some explanatory variables (x), plus an error term that has a standard normal distribution.

$y_i = j \; if \; \mu_{j-1} < y_i^* \leq \mu_j$ for j = 1 to 5

Where cutpoints $\mu_1$through to μ_4 are estimated by Stata and $\mu_0 = -\infty$ and $\mu_5 = \infty$ is assumed

The ordered response model can be written for each outcome as:

$$y_i \begin{cases} 1 \; if \; \mu_0 < y_i^* \leq \mu_1 \\ 2 \; if \; \mu_1 < y_i^* \leq \mu_2 \\ 3 \; if \; \mu_2 < y_i^* \leq \mu_3 \\ 4 \; if \; \mu_3 < y_i^* \leq \mu_4 \\ 5 \; if \; \mu_4 < y_i^* \leq \mu_5 \end{cases}$$

Thus when the latent y* crosses a cutpoint, the observed category changes.

Given the standard normal assumptions for ε_i, the probabilities for each ordinal outcome can be derived as:

$$P\{y_i = 1|x_i\} = P\{\mu_0 < y_i^* \leq \mu_1 \leq 0|x_i\} = \Phi(\mu_1 - x_i\beta)$$

$$P\{y_i = 2|x_i\} = P\{\mu_1 < y_i^* \leq \mu_2 \leq 0|x_i\} = \Phi(\mu_2 - x_i'\beta) - \Phi(\mu_1 - x_i\beta)$$

$$\vdots$$

$$P\{y_i = 5|x_i\} = P\{\mu_4 < y_i^* \leq \mu_5 \leq 0|x_i\} = 1 - \Phi(\mu_4 - x_i\beta)$$

The parameter β and the cutpoints μ are estimated by maximum likelihood.

The marginal effects $P(y = j|x)$are needed for interpretation and are derived as:

$$\frac{\partial P(y=j|x)}{\partial x_k} = \beta_k\left[\phi\left(\mu_{j-1} - x\beta\right) - \phi\left(\mu_j - x\beta\right)\right] \qquad \text{for j = 1 to 5}$$

Appendix 7: Percentage of sample dissatisfied and satisfied

		No qualifications	CSE's	Olevels	A Levels	Diploma	Degree	Higher Degree	Total
0≤x≤4	Dissatisfied	6.2%	8.9%	6.3%	5.3%	6.6%	4.5%	3.5%	294
x=5	Neither satisfied nor dissatisfied	9.9%	6.6%	7.1%	6.9%	4.7%	3.5%	2.9%	306
6≤x≤10	Satisfied	83.9%	84.5%	86.6%	87.8%	88.6%	92.0%	93.5%	4,116
	Total	546	744	1822	20	430	211	170	4,716

Appendix 8: Endogeneity

Consider the following two equations:

Life satisfaction= $\beta_1 CSE + \beta_1 Olevels + \beta_2 Alevels + \beta_3 Diploma + \beta_4 Degree + \beta_5 Higherdegree + \cdots + \varepsilon_1$

CSE= $\beta_1 divorce + \beta_2 poverty + \beta_3 parents\ intererst\ in\ education + \cdots + \varepsilon_2$

The unobserved factors in the second equation such as parents interest in education make it more likely that the highest level of education is low, (such as CSE) which could also explain low life satisfaction scores, resulting in the cov($\boldsymbol{\varepsilon_1}, \boldsymbol{\varepsilon_2}$) $\neq \mathbf{0}$. Therefore, an endogeneity bias would exist.

Possible instruments include generating a rank of family situation using parental divorce and benefits received or using the variable 'How interested are you in your child's education?' as a proxy for parents interest in education. However, such a question is unlikely to always receive an honest response. The instrument used would need to be relevant and exogenous, both of which can be tested.

Appendix 9: Ordered Probit Stata Output with explanation

y= Life satisfaction score					LR Chi-squared (d.f)	12.32 (6)
Number of obs	4716				Prob > chi2	0.0552
Log likelihood	-7037.6648				Pseudo R^2	0.0009
	Coef	Std. Err	z	P>z	[95% Confidence Interval]	
CSE	-0.128	0.060	-2.150	0.031	-0.245	-0.012
O Level	-0.029	0.052	-0.560	0.578	-0.130	0.072
A Level	-0.066	0.068	-0.970	0.332	-0.199	0.067
Diploma	0.037	0.086	0.420	0.671	-0.132	0.205
Degree	0.015	0.059	0.250	0.806	-0.101	0.130
Higher Degree	0.103	0.093	1.100	0.270	-0.080	0.285
/cut1	-1.568	0.051			-1.669	-1.468
/cut2	-0.850	0.047			-0.943	-0.757
/cut3	-0.225	0.047			-0.317	-0.134
/cut4	0.664	0.047			0.572	0.756

The log likelihood is the log of how likely it is that we would observe the data we actually observe, if a given set of parameters were the true parameters. It is always negative because the likelihood is between 0 and 1.

LR chi2(6) is the Likelihood Ratio Chi-Square test (with 6 degrees of freedom) that all the coefficients are simultaneously equal to zero.

The p value is indicated by Prob>chi2 which means it cannot be rejected at the 10% level that the coefficients are equal to zero

Pseudo R-squared is McFadden's R^2 squared which is also known as the 'likelihood-ratio index' but should be interpreted with great caution.

/cut1, /cut2, /cut3, /cut4 are the estimated cutpoints on the latent variable

Appendix 10: How to calculate % of observations correctly predicted

An alternative goodness of fit (R^2) measure for limited dependent variable models is to use the percentage of observations correctly predicted. If we estimate a model, Stata can predict the probability of each outcome of the dependent variable occurring. (Stata command: predict f1 f2 f3 f4 f5) We define a binary predictor ($\widehat{y_i}$) of y_i to = 1 if the predicted probability is at least 0.2 and 0 otherwise.

(Note: In a probit model this would be 0.5, however as the ordered probit model has 5 possible outcomes, I have used the threshold of 0.2: 1 divided by 5 = 0.2)

The percentage of observations correctly predicted is the percentage of times that $\widehat{y_i} = y_i$. Therefore, tabulating $\widehat{y_5}$ when y = 5 will find the percentage of observations correctly predicted for outcome 5. This example uses model 6.

$\widehat{y_5}$	Frequency
0	203
1	949
Total	1152

This implies 949/1152= 82.4% of observations were correctly predicted for outcome 5

The same is done for each outcome for y:

	Observations correctly predicted	Total observations	% correctly predicted
1	7	294	2.4%
2	168	679	24.7%
3	790	1019	77.5%
4	1571	1572	99.9%
5	949	1152	82.4%
Average correct prediction rate	3485	4716	**73.9%**

The measure of goodness of fit can then be the comparison between the average correct prediction of the model (73.9%) with that of a naive estimator. A naive estimator would assume the most common choice for everybody (which is 4) and would be correct 33.3% of the time.

Life Satisfaction	Observations	Percentage
1	294	6.2%
2	679	14.4%
3	1019	21.6%
4	1572	**33.3%**
5	1152	24.4%
Total	4716	100.0%

Therefore this model represents a percentage gain of (73.9-33.3)/66.7=**60.9%**

(Where 66.7 represents the maximum feasible increase in percentage points for this model)

Appendix 11: Percentage of Observations correctly predicted for all models

		Observations correctly predicted													
Life Satisfaction		Model Number						Married Females		Unmarried Females		Married Males		Unmarried Males	
Total Obs		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
294	1	0	0	0	0	9	7	0	0	0	28	0	0	0	33
679	2	0	21	35	50	184	168	0	4	679	499	0	10	575	521
1019	3	1019	851	814	841	781	790	0	104	1019	958	1019	989	1019	1010
1572	4	1572	1572	1572	1572	1571	1571	1572	1572	1572	1496	1572	1572	1572	1475
1152	5	1152	1004	999	975	943	949	1152	1123	201	494	684	550	0	143
4716	Total	3743	3448	3420	3438	3488	3485	2724	2803	3471	3475	3275	3121	3166	3182
		Percentage of observations correctly predicted													
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	1	0.0%	0.0%	0.0%	0.0%	3.1%	2.4%	0.0%	0.0%	0.0%	9.5%	0.0%	0.0%	0.0%	11.2%
	2	0.0%	3.1%	5.2%	7.4%	27.1%	24.7%	0.0%	0.6%	100.0%	73.5%	0.0%	1.5%	84.7%	76.7%
	3	100.0%	83.5%	79.9%	82.5%	76.6%	77.5%	0.0%	10.2%	100.0%	94.0%	100.0%	97.1%	100.0%	99.1%
	4	100.0%	100.0%	100.0%	100.0%	99.9%	99.9%	100.0%	100.0%	100.0%	95.2%	100.0%	100.0%	100.0%	93.8%
	5	100.0%	87.2%	86.7%	84.6%	81.9%	82.4%	100.0%	97.5%	17.4%	42.9%	59.4%	47.7%	0.0%	12.4%
Average correct prediction rate		79.4%	73.1%	72.5%	72.9%	74.0%	73.9%	57.8%	59.4%	73.6%	73.7%	69.4%	66.2%	67.1%	67.5%
Percentage gain		69.1%	59.7%	58.8%	59.4%	61.0%	60.9%	36.7%	39.2%	60.4%	60.5%	54.2%	49.3%	50.7%	51.2%

Appendix 12: How to calculate difference of differences

Calculating the difference of differences allows the evaluation of both males and females to the same default category so that a true comparison can be made. It is calculated by finding the difference between males and females for the same education level and also finding the difference between males and females with no qualifications (the default case).

For example, for O Levels, take the 0.098 marginal effect for the female and O Level interactive dummy and subtract the -0.073 marginal effect on the O Levels dummy. (The O Levels marginal effect is just for men due to the addition of the interactive terms for female and education levels) Then, take the marginal effect for females of 0.019 and subtract the default case of male with no qualifications (0.00). The difference between these two differences is interpreted as females with O Levels are 15.2 percentage points more likely to be completely satisfied than males with no qualifications.

Variables	Marginal Effect on Output 5
CSE	-0.045
O Levels	-0.073
A Levels	-0.056
Diploma	-0.030
Degree	-0.056
Higher Degree	-0.041
Female, CSE	0.004
Female, O Level	0.098
Female, A Level	0.022
Female, Diploma	0.031
Female, Degree	0.059
Female, Higher degree	0.075
Female	0.019

	Female	Male	Difference
O Levels	9.8%	-7.3%	17.3%
No qualifications	1.9%	0.0%	1.8%
Difference	7.9%	-7.3%	**15.2%**