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Personality Characteristics, Educational Attainment and Wages: an economic analysis using the British Cohort Study

PAMELA LENTON*

Abstract

We look at the influence of personality traits and cognitive ability on both educational attainment and on the wages of individuals in the UK labour market at age 33 using the British Cohort Study. We control for a new cluster of nine personality characteristics, some of which we consider likely to influence labour market outcomes. We find that some personality characteristics have significant influence on the acquisition of educational qualifications, in particular internal and external locus of control, conscientiousness and extroversion. Our findings on the extrovert-introvert dimension of personality are paradoxical: we find that males with extrovert personalities have a significantly reduced probability of gaining degree level education, but within the labour market males are rewarded for this characteristic.

JEL Classification: J24

Keywords: Educational attainment; Human capital; Personality Characteristics

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I. Introduction

Since the mid-1980s in the UK there has been a continuing emphasis on the need for young people to succeed in gaining educational qualifications, especially with the introduction of the General Certificate of Secondary Education qualification (GCSE) for students at age 16, which it has been argued has increased the number of qualifications gained by each student and the number of students gaining qualifications (Lenton 2013a). The increase in the number of students gaining GCSE qualifications led to an increase in the proportion staying on at school to undertake Advanced level examinations, seen as the traditional route to higher education. In recent years the number of students taking A levels in the UK has increased from around 311000 in the academic year 2005/6 to over 384000 in the academic year 2011/12 (Department for Education 2013). Furthermore, since 2013 it is compulsory for all students to remain in some form of education or training until the age of 18. The intended consequence of increasing the stock of human capital is to increase the productivity of the UK; however, the demand for educated labour is not limitless and thus, whilst education can significantly enhance productivity, as demonstrated by human capital theory (Becker 1964) or provide a signal of productivity to employers (Spence 1973), given the large proportion of the workforce with qualifications, it cannot guarantee employment or promotion.

The question of how educational attainment is determined and may be influenced is, however, much debated. A long tradition exists of estimating models of human capital to calculate the labour market return to education. However, less attention has been paid by economists to the possible influence of psychological factors on

educational attainment and labour market outcomes. Here, we explore the idea that individual personality characteristics may play an important role in determining both educational attainment and wages in employment.

The identification of personal characteristics that may enhance the employability of graduates are of the utmost importance to institutions of higher education as they increasingly seek a competitive advantage by increasing the employability rates of their graduating body (Lenton 2013b). It is therefore in the interest of educational institutions to develop their students' positive personality characteristics as well as provide academic skills. The present paper is the first, we believe, to consider both the personality traits and the cognitive abilities of individuals on their educational attainment and their subsequent employment outcomes in the UK using the British Cohort Survey. Our approach is to consider the influence of respondents' personality traits measured when they are aged 16 on their educational attainment and on their observed wage at age 33. We argue that certain personality characteristics, alongside innate ability and family background which influence one's taste for education, play a large part in academic success which in turn leads to positive labour market outcomes, in particular in the form of higher wages. Personality characteristics measured at age sixteen have been shown to be stable over time (Judge et al 1999; Roberts et al 2001; Cobb-Clark and Schurer 2012), therefore this facilitates our analysis because our personality traits are exogenous to our outcome measures; neither educational attainment nor the labour market wage affects our personality traits which are measured first. Following Spence's (1973) Job Signalling Theory, we argue that certain personality characteristics are key, along with innate ability, in enabling young people to achieve academic success, and it

is these personality traits that employers seek in their potential employees, when they screen the educational attainment of their job candidates.

One of the most obvious questions which arises is which personality traits matter? A few early papers in the economic psychology literature have concentrated on the effect of possessing a single type of personality trait on the labour market outcome of an individual, such as self-esteem (Goldsmith et al. 1997; Murnane et al. 2001). Two popular classes of personality characteristics are highlighted by the economic-psychology literature, which are the Rotter (1966) scale of locus of control(Osborne Groves 2005;Semykina and Linz 2007) and the so-called 'big five' personality traits (conscientiousness, extroversion, agreeableness, (in)stability and openness (Digman 1989,Nyhus and Pons 2005; Mueller and Plug 2006; Heineck 2007)). In this research, our data allows us to construct nine personality trait measures which include the 'big five' along with both the internal and external locus of control, affiliation and challenge. The present analysis is, to our knowledge, the first analysis to review all these highlighted personality traits together.

We start with the 'big five'. *Conscientiousness* refers to an individual's level of dedication and effort in working toward one's goal. Conscientious individuals are expected to perform well academically as they are most likely to be organised in their studies, working to study plans and regularly completing their homework and further reading. We would also expect these individuals to perform well in work as they are most likely to take pride in their work and pay attention to detail. *Extroversion* is typically a characteristic of a confident individual who is keen to be noticed by others. The individual with this characteristic is confident in social situations and typically ambitious,

so we may expect this to be a positive characteristic with respect to educational attainment and career progression. However, an extrovert personality may not be an indicator of positive educational attainment if a child's extroversion is focused on outside interests to the detriment to his or her studies. Additionally, extroversion often goes hand in hand with a dominant streak, which if associated with a leader or manager, may indicate a need to take control in teamwork situations and therefore more likely to be seen as over-confident or even as having a bullying nature, and thus not viewed as stable management material.

Agreeableness, the extent to which an individual gets along with others, is important in both the classroom and work setting as a means of avoiding conflict with teachers or work colleagues, and agreeableness is likely to be a desirable trait in an employee in a managerial position. Neuroticism (or *instability*) is a characteristic of an individual who is anxious most of the time and whose performance both academically and in employment may suffer as a consequence of possessing this character trait. Individuals with this trait may lack confidence and tend to shy away from new experiences and associations which would increase their performance. The final trait of the big five is *openness* which is a characteristic of a more assertive personality where an individual is likely to gain increased knowledge from new practical experiences. It has been argued that individuals who are open to new experience are typically flexible, creative and intellectually orientated (Heineck and Anger 2010).

Going beyond the 'big five', the other four personality traits we consider are; first, *internal locus of control*, whether one has a belief that one's destiny is in one's own hands and that hard work, either in an educational setting or in employment will bring

rewards. It differs from conscientiousness in that this trait implies a long-term mindset which may result in an attitude of ‘not giving up’ if problems arise. Its opposite, *external locus of control,* indicates a belief that the task in hand, whether it be schooling or in the workplace, is futile because however much effort is applied the desired result may not occur. The individual with this mindset is most likely to lack any motivation because they do not believe their effort will be recognised and that their fate is in the hands of others, and so we would expect this individual to have low academic achievement. Our final two traits under consideration are *challenge* and *affiliation*. Challenge sounds similar to openness but actually indicates a strong desire to ‘get ahead’ (Semykina and Linz 2007); individuals possessing this personality trait are most likely to be extremely confident in their capabilities. Affiliation is the need for warmth and friendship from one’s peers, teachers and in a work setting, from the boss and one’s colleagues. Individuals who possess this personality trait have a need to ‘get along’ with others and can be extremely upset by conflict which would damage their productivity. However, in a happy and relaxed working environment they are able to be extremely productive.

This paper examines the effect of all the nine personality characteristics discussed above and which are reported at age 16, on educational attainment and also on the subsequent wage at age 33 separately for males and females. In the following section the related literature is outlined. The data, construction of the personality variables and the econometric methods are discussed in section 3. In section 4 we present our results and we draw our conclusions in section 5.

2. Literature

The economic-psychology literature began by looking at the effect of personality characteristics on labour market wages. Early papers in the US, (Goldsmith et al., 1997; Murnane et al. 2001) investigated the role of self-esteem when young on the subsequent wage using the National Longitudinal Survey of Youth (NLSY) and found significant effects. Goldsmith et al. (1997) found that a 10% increase in predicted self-esteem improved real wages by almost 5% in 1980 which had risen to 13% by 1987. Judge et al (1999) claim that, amongst the big five personality traits, conscientiousness, extroversion and neuroticism are the most important for career success, although their sample, from the University of California at Berkeley was small.[1] However, they estimated separate regressions which included measures of child personality and adult personality and found similar effects, thus indicating the stability of the characteristics over time. Bowles et al (2001) used NLSY and using the Rotter scale of efficacy found both positive and negative effects to personality type. Dunifon and Duncan (1998), again looking at the US labour market but using the Panel Survey of Income Dynamics, found locus of control to be a significant positive factor influencing wages. The problem of separating out the separate influences on the wage of cognitive ability and education has been acknowledged (Cawley et al. 2001), especially since non-cognitive traits are seen to be rewarded in the labour market. A number of studies have considered the influence from the big five personality traits on the wage in different countries (Nyhus and Pons 2005; Mueller and Plug 2006; Heineck 2007; Heineck and Anger 2010; Gensowski 2013). Nyhus and Pons (2005), using Dutch data find differences in the effect of the personality variables on the wage between genders until they include

[1]The sample in Judge et al. (1999) regression models contained 118 observations.

education in their explanatory variables, which they claim suggests that the return to education is overstated in human capital models[2]. Mueller and Plug (2006) find the big five personality variables to have a similar effect on wages to that from cognitive ability for their sample of Wisconsin high school graduates. Heineck (2007), using cross-sectional UK data, finds openness to bring a small return on the wage for females only but a wage penalty to agreeableness for both genders whereas Heineck and Anger (2010), using German panel data, find the wage penalty to agreeableness applies to females only and that there is a larger wage penalty to external locus of control. Gensowski (2013) distinguishes between IQ and educational attainment in her study where she uses the Terman study data of high IQ[3] individuals, who were first interviewed as children in the US in 1922, to examine the effect of personality on individual earnings and household earnings. She finds a wage premium for males only who possess a high IQ and also the personality traits of extroversion and conscientiousness.

Osborne Groves (2005) uses the Rotter (1966) scale in her examination of personality traits on the wage for women in the US and in the UK, finding an 8% wage penalty to having an aggressive personality. Semykina and Linz (2007) examine the personality traits of internal and external locus of control along with affiliation and challenge to help explain male-female differences in wages in Russia. They conclude that personality accounts for 8% of the wage differential between men and women. De Araujo and Lagos (2013) using US data find that self esteem largely influences the wage indirectly through educational attainment.

[2]Nyhus and Pons (2005) do not include occupational controls in their regressions which are likely to be determined by education and personality.

[3] High IQ individuals are those who have a recorded score of 140 or above.

The psychology literature has considered the ways in which personality traits influence aspects of learning and attainment (see De Raad and Schouwenburg 1996, for a review of this literature). Poropat (2009) conducted a meta-analysis of the big five personality traits and concludes that conscientiousness has the largest positive influence on educational attainment whilst openness has a small positive effect, however, Gensowski (2013) claims openness is correlated with IQ so it does not exert a significant influence on attainment where IQ is controlled for. Almund et al. (2011) find that personality characteristics shape cognition and that these can be shaped by external interventions. More recently, De Araujo and Lagos (2013) find self esteem to have a significant positive influence on educational attainment which has a larger effect for males. Heckman et al. (2013) have shown that interventions to enhance personality skills in the Perry preschool program in the US have led to sizeable treatment effects and positive adult outcomes, which include labour market outcomes. This implies that personality traits can be shaped. Borghans et al. (2008) examine whether or not personality traits are stable over time and conclude that this is the case and that they are also excellent predictors of socioeconomic success which can be shaped by early interventions.

3. Data and Methods

The data comes from the 1970 British Cohort Survey follow-ups of 1986 and 2004. The BCS70 longitudinal survey follows a panel of children born in the UK between 5th and 11thApril 1970.

The sixteen year follow-up in 1986 carried out by the International Centre for Child Studies and referred to as 'Youthscan'[4] at the time of data collection, gathered a plethora of information, including attitudes and personality traits along with ability measures and demographic information not commonly found within a single survey and which is essential for our present analyses. The many instruments of the 16 year follow-up survey, when all respondents were still in school, included a four-day diary, a series of educational assessments within the questionnaire, predicted grades for the exams that were due to be taken later in that year which included the General Certificate of Education (GCE) and the Certificate of Secondary Education (CSE), demographic information on family background and a medical assessment. Additionally, an attitudinal section of the survey recorded young peoples' self-reported attitudes to life at that time. The life subjects covered 21 categories, including category headings such as, 'what's in a job?', 'what about work?', 'knowing myself', 'compared to others' and 'how I feel'. In addition to the main questionnaires given to respondents, separate questionnaires were sent to respondents' teachers, head teachers and parents to provide their opinion of the respondent. And finally a separate booklet was sent to parents to obtain further family background information, specifically parental economic activity, socioeconomic status, and parental educational attainment. The total number of observations in the age 16 dataset is 11622; however, not all questionnaires were returned for all respondents,

[4]'Youthscan' is now referred to as BCS70 age 16. The birth survey included those born in Northern Ireland but these 626 respondents were not re-interviewed in subsequent surveys.

indeed the design of the survey into separate questionnaire booklets meant that a smaller sample was obtained, with fewer than expected responses from all questionnaires: for example, the questionnaire on student scores produced only 6003 observations and the family background information produced 7336 observations, although not all matching respondents in either one.[5]

We utilise the statements made in the BCS70 survey at age 16 in order to construct our nine personality traits from the answers provided to the questions in the attitudinal questionnaire, which are given before respondents have any experience of the labour market, thus eliminating possible endogeneity from the influence of the individual's job characteristics and their job satisfaction on responses which would occur if attitudes were recorded at age 33. If personality is shaped by an individual's labour market success then our personality traits would be overstated if we did not take account of this problem, and one way of overcoming this is to use measures taken prior to labour market experience to reflect current personality traits (Osborne Groves 2005). We are confident that the measures taken at age 16 reflect personality at age 33: the stability of individual personality traits over time has been confirmed (Costa and McCrae, 1997; Borghans et al. 2008), especially between adolescence and adulthood (Roberts et al 2001; Srivastava et al. 2003; Cobb-Clark and Schurer 2012). Judge et al, (1999) using US panel data, have found that the effects on adult wages from the big five personality traits were virtually the same, whether the traits were measured when the respondent was a child or an adult. In the BCS70 survey respondents are asked

[5]See the BCS70 1986 Follow-up user guide for the breakdown of responses to each section of the survey.

questions about their attitudes towards work, their current lifestyle behaviours and are asked to rate themselves on a four-point Likert scale, from the statement 'does not apply' or 'do not agree', which takes a value of zero, to 'applies totally' or 'definitely agrees', which takes a value of 3. To construct our personality traits we use factor analysis to identify a separate set of three questions specific to each personality trait. The mean responses to the questions for males and females, along with the overall mean for each personality trait, are given in table 1 below. We examine by gender as personality traits have been found to have significant differences on educational attainment and the wage for each group (Nyhus and Pons 2005; Semykina and Linz 2007; Gensowski 2013; de Araujo and Lagos 2013).

Following the economic-psychology literature using personality measures (Nyhus and Pons 2005; Muller and Plug 2006; Brown and Taylor 2008; Heineck 2007; Heineck and Anger 2010) we construct the standardized Chronbach alpha reliability index to verify the internal consistency of the three questions in each category of personality[6]. The reliability measures for males (females) are internal locus of control, 0.75 (0.68); external locus of control, 0.67 (0.66); challenge, 0.81 (0.77); affiliation, 0.69 (0.64); conscientiousness, 0.85 (0.82); extroversion, 0.79 (0.79); agreeableness, 0.82 (0.78); neuroticism 0.70 (0.68) openness, 0.56 (0.51).

Table 1 Constructed measures of personality traits

[6] The majority of our measures pass the rule of thumb of 0.7 and all are comparable with those reported in the literature (Mueller and Plug 2006; Heineck and Anger 2010). We note that this rule of thumb is disputed in the literature (Schmitt 1996) and although widely used as a standard its statistical reliability has been questioned (Sijtsma 2009; McCrae at al 2011).

Personality Trait (Cronbach's alpha)	Constructed from BCS70 1986 responses to questions:	Mean (*Standard deviation*) Males	Mean(*Standard deviation*) Females
Internal locus of control	1. Qualified people have more chance of getting a job.	2.358 (*0.816*)	2.291 (*0.778*)
	2. It is not what you know but who that decides your job. (Reversed)	2.051 (*0.767*)	2.187 (*0.764*)
	3. If you are really determined it is possible to get a job.	2.414 (*0.857*)	2.415 (*0.800*)
Overall Mean (Standard Deviation)		2.260 (*0.664*)	2.249 (*0.603*)
External locus of control	1. With unemployment it is just chance if you get a job or not.	1.479 (*0.741*)	1.605 (*0.759*)
	2. Full-time education only puts off the time you become unemployed.	1.334 (*0.729*)	1.315 (*0.678*)
	3. It is no good planning a career when there aren't enough jobs.	1.208 (*0.645*)	1.141 (*0.556*)
Overall Mean (Standard Deviation)		1.341 (*0.548*)	1.354 (*0.514*)
Challenge	It matters to have an interesting job with variety.	2.469 (*0.838*)	2.579 (*0.767*)
	It matters to get promotion so I can get ahead.	2.270 (*0.888*)	2.223 (*0.848*)
	It matters to get a job with a real challenge.	2.060 (*0.861*)	2.104 (*0.842*)
Overall Mean (Standard Deviation)		2.289 (*0.711*)	2.302 (*0.677*)
Affiliation	It matters to have an understanding boss.	2.093 (*0.802*)	2.374 (*0.763*)
	It matters to help other people.	2.400 (*0.845*)	2.440 (*0.793*)
	It matters to have a quiet life.	1.538 (*0.790*)	1.336 (*0.672*)
Overall Mean (Standard Deviation)		2.010 (*0.639*)	2.060 (*0.567*)
Conscientiousness	I am punctual.	2.233 (*0.906*)	2.281 (*0.866*)
	I am a responsible person.	2.261 (*0.836*)	2.386 (*0.797*)
	I am reliable.	2.313 (*0.866*)	2.419 (*0.801*)
Overall Mean (Standard Deviation)		2.269 (0.*765*)	2.357 (*0.704*)
Extroversion	I am quiet. (Reversed)	1.936 (*0.812*)	2.051 (*0.784*)
	I am shy. (Reversed)	2.003 (*0.891*)	2.074 (*0.880*)
	I am popular.	2.058 (*0.797*)	2.078 (*0.744*)
Overall Mean (Standard Deviation)		2.049 (*0.685*)	2.067 (*0.676*)
Agreeableness	I am friendly.	2.323 (*0.834*)	2.449 (*0.794*)
	I am helpful.	2.072 (*0.782*)	2.188 (*0.754*)
	I am obedient.	1.927 (*0.792*)	1.994 (*0.765*)
Overall Mean (Standard Deviation)		2.107 (*0.686*)	2.210 (*0.645*)
Neuroticism	I am nervous.	1.491 (*0.768*)	1.657 (*0.776*)
	I have felt constantly under strain.	1.647 (*0.943*)	1.826 (*0.999*)
	I have been losing confidence in myself.	1.424 (*0.847*)	1.617 (*0.916*)
Overall Mean (Standard Deviation)		1.521 (*0.677*)	1.700 (*0.705*)
Openness	I am keen on many different things.	2.202 (*0.865*)	2.203 (*0.799*)
	I do volunteer/community work.	1.148 (*0.730*)	1.274 (*0.816*)
	I go to meetings/political rallies.	1.032 (*0.589*)	1.050 (*0.590*)
Overall Mean (Standard Deviation)		1.461 (*0.534*)	1.509 (*0.524*)

The 2004 follow-up survey documents the life outcomes of our individuals when they are aged 33. The information collected includes current economic status including job details such as: hours worked and wage information for those in work, health status, opinions held and demographic information. For our analysis of the effect of personality traits on educational attainment by age 33 we include individuals who completed the survey test and the attitudes questionnaire at age 16, whose parents completed their questionnaires and who also provided information at age 33. This provides us with a sample of 4294 individuals, comprising 1758 males and 2536 females. For our examination of whether child personality traits influence wages when aged 33 we additionally require labour market information, specifically respondents' occupation and wage information, which provides us with a sample of 2483 individuals, comprised of 1377 males and 1106 females. Descriptive statistics for both samples are provided in table 2.

Table 2 Descriptive statistics

	Educational Attainment sample				Wage sample			
	Male N= 1758		Female = 2536		Male N=1377		Female N=1106	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Log wage	-	-	-	-	2.32	0.62	2.06	0.65
Test score age 16	41.95	14.91	39.94	14.84	41.84	14.85	0.00	0.00
No Qualifications NVQ0	0.05	0.23	0.05	0.21	0.05	0.21	0.03	0.17
Qualification NVQ1	0.12	0.33	0.12	0.32	0.12	0.32	0.08	0.27
Qualification NVQ2	0.29	0.45	0.31	0.46	0.28	0.45	0.26	0.44
Qualification NVQ3	0.12	0.32	0.10	0.30	0.12	0.33	0.10	0.30
Qualification NVQ4	0.32	0.47	0.34	0.47	0.34	0.47	0.41	0.49
Qualification NVQ5	0.09	0.29	0.09	0.28	0.10	0.30	0.13	0.34
Parents had Degree	0.18	0.39	0.17	0.37	0.19	0.39	0.19	0.39
Parents had A levels	0.08	0.28	0.09	0.29	0.08	0.27	0.10	0.29
Parents had O levels	0.27	0.38	0.28	0.38	0.28	0.39	0.28	0.38
Parents no Qualifications	0.46	0.49	0.46	0.50	0.44	0.49	0.43	0.49
Married	-	-	-	-	0.76	0.43	0.65	0.48
Number of Children	-	-	-	-	2.90	1.25	2.50	1.16
Experience	-	-	-	-	10.19	5.69	11.06	5.59
Experience Squared	-	-	-	-	136.16	109.26	153.47	111.15
Promoted	-	-	-	-	0.32	0.47	0.34	0.47
London	-	-	-	-	0.09	0.29	0.10	0.29
Managerial or Professional	-	-	-	-	0.25	0.43	0.24	0.43
Associate Professional	-	-	-	-	0.16	0.37	0.18	0.38
Technical and related	-	-	-	-	0.17	0.37	0.19	0.39
Administrative/secretarial	-	-	-	-	0.06	0.23	0.20	0.40
Craft	-	-	-	-	0.13	0.33	0.01	0.10
Personal Services	-	-	-	-	0.07	0.25	0.08	0.26
Wholesale and retail	-	-	-	-	0.03	0.16	0.05	0.22
Machine Operatives	-	-	-	-	0.09	0.28	0.03	0.15
Other unskilled manual	-	-	-	-	0.04	0.20	0.02	0.10

3.1 Methods

Mincerian earnings functions

The issue of whether personality characteristics play a significant role in determining the wage is complex. We begin by estimating traditional models of human capital that use a Mincerian earnings function, separately for males and females, and where our dependent variable is the natural logarithm of wages at age 33.

$$\ln Y_{i,33} = \alpha_0 + \beta \mathbf{x}_{i,33} + \varepsilon_i; \qquad (1)$$

where the vector x_i, consists of individual characteristics related to earnings, including the level of education attained, which is measured as the National Vocational Qualification (NVQ)[7] level attained by age 33, along with demographic information, experience in the job and occupational dummies. The corresponding parameters to be estimated are α and β; ε denotes the error term. We must control for sample selection bias because wages are only observable for employed individuals and we do this by using the Heckman correction procedure.[8]

Next we use the same Mincerian earnings function estimation but in addition to the vector of individual characteristics measured at age 33, we include our nine personality traits outlined above, measured when individuals are aged 16 in order to examine which traits are significant and whether or not the inclusion of these traits significantly changes the coefficients on the educational measures.

$$\ln Y_{i,33} = \alpha_0 + \beta \mathbf{x}_{i,33} + \pi \mathbf{z}_{i,16} + \varepsilon_i; \qquad (2)$$

The use of personality characteristics measured at age 16 before entering the labour market eliminates the endogeneity that is argued to be present in models containing personality at age 33 (Goldsmith et al. 2000; Osborne Groves 2005; Semykina and Linz 2007), that stems from uncertainty about whether positive personality characteristics lead to success in the labour market or whether labour

[7] The NVQ level ranges from 0, no qualifications to 5 a postgraduate qualification.
[8] We estimate probit models for the selection equations where parental educational levels are used for the exclusion restrictions, which are most likely to influence the amount of education taken by the individual but not the wage observed. The wage equations are then estimated with bootstrapped standard errors.

market success shapes personality characteristics. Personality characteristics are argued to be relatively stable across time (Borghans et al. 2008) therefore the use of age 16 personality characteristics is a good proxy for individuals' personality at age 33.

A further specification is estimated that includes personality characteristics but replaces the educational attainment measures with test scores at age 16 as a measure of innate ability[9]. Personality characteristics may be thought of as an individual's set of productive traits valued in the labour market (Mueller and Plug 2006). Therefore, test scores at age 16 are a measure of innate ability, rather than qualifications which may be influenced by family background and personality characteristics[10].

Educational attainment; ordered probit estimation

We believe that personality traits influence the level of education an individual undertakes; indeed, some personality characteristics are likely to be reinforced, for example a student who believes he can achieve success in his studies, works conscientiously and achieves his desired results is likely to continue in education and his level of conscientiousness will persist. Thus, personality traits can motivate the student to study and it is these traits, according to signalling theory (Spence 1973), that are the unseen characteristics that potential employees are drawing attention to by means of their qualifications. Hence, in the previous models of the effect of personality traits on the wage, the endogeneity of personality traits on educational attainment is not taken into account. We therefore turn our attention to the influence of personality traits

[9] We acknowledge that this test is not a perfect measure of innate ability because at age sixteen, ability will have some influence from family background and the test itself is a construct and therefore open to criticism as an imperfect measure.

[10] This is a contentious argument that we wish to test here as we believe that results from tests at age 16 are likely to include influences from family background and personality traits.

on educational attainment, specifically the attained NVQ level and begin by estimating an ordered probit model (see Greene 2003 p 736) which is built around a latent dependent variable:

$$E^* = \mathbf{x}'_{i33}\,\boldsymbol{\beta} + \varepsilon \qquad (3)$$

where y* is the unobserved variable. We observe:

$$E = 0 \quad \text{if } E^* \leq 0,$$
$$= 1 \quad \text{if } 0 < E^* \leq \mu_1,$$
$$= 2 \quad \text{if } \mu_1 < E^* \leq \mu_2,$$
$$\ldots$$
$$= J \quad \text{if } \mu_{J-1} < E^*,$$

where the μ's are unknown parameters to be estimated with $\boldsymbol{\beta}$.

Finally, we examine if there is an influence from personality traits measured at age 16 on the wage at age 33 after controlling for the effect of personality on educational attainment.

$$\ln Y_{i,33} = \alpha_0 + \beta \mathbf{x}_{i,33} + \pi \mathbf{z}_{i,16} + \gamma \mathbf{E}_{i,33} + \varepsilon_i; \qquad (4)$$

$$E_i = \alpha_0 + \beta \mathbf{x}_{i,33} + \pi \mathbf{z}_{i,16} + \varepsilon_i \qquad (5)$$

To conduct this analysis we estimate an ordered probit selection model (see Greene 2003). The model is identified by the inclusion of dummy variables that capture parental education levels in the selection equation which are excluded from the wage equation. Our choice of exclusion restriction is based on previous work that finds parental education to be a good identifier because parents' educational attainment influences their children's educational attainment but not their children's wage (Wang et al 1999; Heckman et al 2006; de Araujo and Lagos 2013).

4. Results

The estimates from our Mincerian earnings functions, which include the selection of individuals into the labour market, are provided in tables 3 and 4 below for males and females, respectively. In the first column of each of the tables we see the human capital specification where our base individual is single, in a craft occupation with no educational attainment. We see in this specification the positive effect on the wage from our human capital dummy variables of NVQ level for both genders, which increase with the level of educational attainment, as we would expect. The second column of tables 3 and 4 show that when we add the personality characteristic variables to the model there is a slight reduction in the coefficients on educational attainment, for both genders. Turning to the statistically significant personality characteristics we see that for both genders, locus of control is influential on the wage. A belief that hard work will be rewarded will encourage the individual to be more productive and thus has a positive influence on the wage, increasing the wage by around 3 (4) percent for males (females), whilst conversely, a belief that one's effort will not be rewarded is likely to lead to less effort being applied, and we see a wage penalty to this trait of 3 (4) percent for males (females). There are differences in the importance of personality traits between the genders; males are rewarded for extroversion and penalised for affiliation and instability whereas females are rewarded for conscientiousness. Females are found to have a wage penalty for agreeableness, which appears perverse but has been found in the literature (Nyhus and Pons (2005) and Heineck and Anger (2010), using Dutch and German data, respectively). A possible explanation for this finding is that women are more often found in lower paid jobs where they may be required to be agreeable, such

Table 3. The effects of personality traits on wages for employees at age 33: males.

N=1377	**Human Capital model**		**Human Capital model with personality Traits**		**Personality Traits with Ability at Age 16**	
	Coefficient	Bootstrap Std error	Coefficient	Bootstrap Std error	Coefficient	Bootstrap Std error
Married	0.378***	(0.061)	0.314***	(0.065)	0.000	(0.076)
Number of children	-0.068***	(0.018)	-0.057***	(0.019)	0.010	(0.021)
Managerial or Professional	0.098**	(0.047)	0.081	(0.050)	0.092*	(0.051)
Associate Professional	0.109*	(0.058)	0.099*	(0.057)	0.106*	(0.057)
Technical and related	0.068	(0.054)	0.072	(0.053)	0.087*	(0.052)
Administrative/secretarial	-0.137*	(0.081)	-0.132	(0.085)	-0.120	(0.081)
Personal Services	-0.141*	(0.076)	-0.143**	(0.073)	-0.156***	(0.061)
Wholesale and retail	0.081	(0.142)	0.089	(0.133)	0.087	(0.138)
Machine Operatives	-0.073	(0.049)	-0.051	(0.051)	-0.055	(0.049)
Other unskilled manual	-0.191***	(0.054)	-0.169***	(0.068)	-0.169***	(0.052)
Experience	0.007	(0.012)	0.007	(0.012)	0.006	(0.010)
Experience squared	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)
Promoted	0.086**	(0.038)	0.079**	(0.040)	0.074**	(0.037)
NVQ level 1	0.024	(0.056)	0.035	(0.066)		
NVQ level 2	0.065	(0.050)	0.062	(0.064)		
NVQ level 3	0.174***	(0.065)	0.148*	(0.079)		
NVQ level 4	0.358***	(0.072)	0.313***	(0.074)		
NVQ level 5	0.442***	(0.086)	0.363***	(0.089)		
London	0.371***	(0.043)	0.349***	(0.047)	0.336***	(0.041)
Internal locus control			0.026***	(0.010)	0.023**	(0.011)
External locus control			-0.028***	(0.010)	-0.026**	(0.012)
Challenge			0.018	(0.011)	0.017*	(0.010)
Affiliation			-0.034***	(0.011)	-0.034***	(0.012)
Conscientiousness			-0.014	(0.010)	-0.013	(0.011)
Extroversion			0.026***	(0.010)	0.023**	(0.010)
Agreeableness			0.019	(0.014)	0.021	(0.014)
Neuroticism			-0.015*	(0.009)	-0.016	(0.010)
Openness			0.005	(0.017)	0.003	(0.016)
Test age 16					0.008***	(0.002)
Inverse mills ratio	2.146***	(0.430)	1.706***	(0.452)	1.142**	(0.570)
Constant	1.243***	(0.174)	1.324***	(0.168)	2.140***	(0.168)
R2	0.1737		0.1945		0.1932	
Wald chi2	507.38		624.74		589.46	
Prob> chi2	0.0000		0.0000		0.0000	

NOTE: *,** and *** denote significance at the 10%, 5% and 1% levels, respectively. The inverse mills ratios to correct for sample selection are derived from bootstrapping with 200 replications.

as personal services and retail services. Column 3 of tables 3 and 4 show our specification with personality characteristics included but with test score at age 16 as a measure of innate ability and the attainment dummies omitted. The estimates of the

Table 4. The effects of personality traits on wages for employees at age 33: females.

N=1106	**Human Capital model**		**Human Capital model with personality Traits**		**Personality Traits with Ability at Age 16**	
	Coefficient	Bootstrap Std error	Coefficient	Bootstrap Std error	Coefficient	Bootstrap Std error
Married	-0.027	(0.060)	-0.007	(0.060)	0.103	(0.069)
Number of children	-0.033	(0.060)	-0.011	(0.064)	-0.246***	(0.101)
Managerial or Professional	0.141*	(0.076)	0.117*	(0.071)	0.125*	(0.068)
Associate Professional	0.252***	(0.074)	0.215***	(0.077)	0.262***	(0.071)
Technical and Related	0.072	(0.074)	0.058	(0.079)	0.097	(0.074)
Administrative/secretarial	-0.079	(0.077)	-0.088	(0.074)	-0.104	(0.075)
Personal Services	-0.125*	(0.074)	-0.116	(0.077)	-0.121	(0.076)
Wholesale and retail	-0.321***	(0.106)	-0.302***	(0.103)	-0.308***	(0.107)
Machine operatives	-0.415*	(0.263)	-0.362	(0.234)	-0.423*	(0.247)
Other unskilled manual	-0.372***	(0.121)	-0.366***	(0.124)	-0.367***	(0.098)
Experience	0.020*	(0.012)	0.020	(0.014)	0.021*	(0.013)
Experience squared	-0.002**	(0.001)	-0.002**	(0.001)	-0.002**	(0.001)
Promoted	0.050	(0.051)	0.040	(0.048)	0.044	(0.054)
NVQ level 1	-0.005	(0.068)	-0.016	(0.069)		
NVQ level 2	-0.002	(0.069)	-0.033	(0.070)		
NVQ level 3	0.048	(0.073)	0.001	(0.081)		
NVQ level 4	0.137**	(0.070)	0.121**	(0.064)		
NVQ level 5	0.146*	(0.080)	0.125	(0.088)		
London	0.262***	(0.063)	0.253***	(0.066)	0.245***	(0.066)
Internal locus control			0.045***	(0.010)	0.044***	(0.015)
External locus control			-0.038***	(0.013)	-0.033***	(0.011)
Challenge			0.014	(0.014)	0.012	(0.015)
Affiliation			-0.016	(0.023)	-0.014	(0.019)
Conscientiousness			0.048***	(0.017)	0.048***	(0.016)
Extroversion			-0.005	(0.012)	-0.005	(0.012)
Agreeableness			-0.038**	(0.018)	-0.036***	(0.014)
Neuroticism			-0.014	(0.011)	-0.015	(0.011)
Openness			-0.000	(0.023)	-0.002	(0.024)
Test age 16					0.010***	(0.002)
Inverse mills ratio	-0.833**	(0.420)	-1.406**	(0.752)	-1.528**	(0.779)
Constant	2.187***	(0.124)	2.013***	(0.156)	1.360***	(0.249)
R2	0.2022		0.2259		0.2305	
Wald chi2	535.52		757.39		767.95	
Prob> chi2	0.0000		0.0000		0.0000	

NOTE: *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.The inverse mills ratios to correct for sample selection are derived from bootstrapping with 200 replications.

personality variables are virtually identical to the model with educational attainment levels except that challenge is shown to have a significantly positive influence on the wage for males. The inverse Mills ratio is highly statistically significant in all

specifications but we note that the sign is different between the genders. The implication is that the coefficients from an OLS model for males would be biased upwards but for females would be biased downwards.

We now discuss the results of our ordered probit models of the influence of personality traits on educational attainment, the marginal effects of which are shown in tables 5 and 6 for males and females, respectively. The categories of NVQ4 and 5 have been combined in this analysis. The importance of family background, specifically the educational attainment of one's parents, is clearly shown in the results, which indicates the taste for education within the family and the expectations of parents that their children succeed in their studies. The marginal effects for the continuous variables are calculated as average marginal effects estimated at the means of all variables. Whilst having only a small effect, we note that the marginal effects from the vocabulary test scores have a significantly positive influence of ability on educational attainment of NVQ level 3 or above. Turning to the marginal effects from the personality characteristic variables we see that for both genders having a high internal locus of control leads to an increased probability of success in higher education (NVQ levels 4/5) of around 3 (2) percentage points for males (females) and a reduced probability of low educational attainment, which would be expected if respondents have a positive mental attitude and believe they can succeed if they put in the effort required. Conversely, for both genders having a high score on the external locus of control scale indicates a reduction in the probability of obtaining a degree (NVQ level 4/5); specifically at the mean value the marginal effect shows a decrease of around 5 percentage points. Thus a negative

Table 5. The effect of personality on NVQ level achieved: Males

	Marginal Effects from the ordered probitmodel of NVQ level			
N= 1758	NVQ Level 0-1	NVQ Level 2	NVQ Level 3	NVQ Level 4-5
Parent has a degree -NVQ 4	-0.124***	-0.176***	-0.020***	0.320***
	(0.105)	(0.020)	(0.006)	(0.032)
Parent has A levels - NVQ 3	-0.077***	-0.103***	-0.008*	0.188***
	(0.013)	(0.024)	(0.005)	(0.040)
Parent has O levels - NVQ 2	-0.040***	-0.043***	0.000	0.082***
	(0.013)	(0.016)	(0.001)	(0.030)
Vocabulary Test score	-0.005***	-0.005***	0.003***	0.008***
	(0.000)	(0.001)	(0.000)	(0.001)
Internal locus of control	-0.018***	-0.016***	0.001**	0.027***
	(0.005)	(0.004)	(0.000)	(0.009)
External locus of control	0.033***	0.030***	-0.002**	-0.049***
	(0.004)	(0.004)	(0.001)	(0.008)
Challenge	-0.020***	-0.018***	0.001**	0.029***
	(0.005)	(0.004)	(0.000)	(0.007)
Affiliation	0.025***	0.023***	-0.001**	-0.036***
	(0.005)	(0.005)	(0.001)	(0.007)
Conscientiousness	0.003	0.003	0.000	0.004
	(0.004)	(0.004	(0.000)	(0.006)
Extroversion	0.020***	0.018***	-0.001**	-0.029***
	(0.004)	(0.004)	(0.000)	(0.006)
Agreeableness	-0.008	-0.008	0.000	0.012
	(0.005)	(0.005)	(0.000)	(0.008)
Neuroticism	0.009***	0.008***	0.000*	-0.014***
	(0.003)	(0.003)	(0.000)	(0.005)
Openness	-0.005	-0.005	0.000	0.008
	(0.005)	(0.005)	(0.000)	(0.008)
Log Likelihood -1952.6555				
Prob> chi2 = 0.0000				

NOTE: *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

attitude to the value of studying, perhaps because the individual believes it will not lead to success in the future, leads to a reluctance to study by the individual. The desire for a challenge is also shown to be an important influence on educational attainment for both genders, with the marginal effect showing a three percentage point increase in the probability of attaining higher educational qualification for individuals at the mean value of this scale. Affiliation has a significantly negative effect on educational attainment for both genders. Interestingly, extroversion has no

Table 6 The effect of personality on NVQ level achieved: Females

	Marginal Effects from the ordered probit model of NVQ level			
N= 2536	NVQ Level 0-1	NVQ Level 2	NVQ Level 3	NVQ Level 4-5
Parent has a degree -NVQ 4	-0.107***	-0.169***	-0.014***	0.290***
	(0.008)	(0.018)	(0.004)	(0.027)
Parent has A levels - NVQ 3	-0.073***	-0.109***	-0.007**	0.190***
	(0.010)	(0.020)	(0.003)	(0.032)
Parent has O levels - NVQ 2	-0.038***	-0.046***	0.000	0.084***
	(0.010)	(0.014)	(0.001)	(0.025)
Vocabulary Test score	-0.005***	-0.005***	0.001***	0.008***
	(0.000)	(0.000)	(0.000)	(0.001)
Internal locus of control	-0.009***	-0.009***	0.001*	0.015***
	(0.003)	(0.003)	(0.000)	(0.006)
External locus of control	0.028***	0.029***	-0.001***	-0.046***
	(0.004)	(0.004)	(0.007)	(0.006)
Challenge	-0.019***	-0.019***	0.001***	0.031***
	(0.003)	(0.004)	(0.000)	(0.005)
Affiliation	0.014***	0.015***	-0.001**	-0.023***
	(0.004)	(0.004)	(0.000)	(0.007)
Conscientiousness	-0.006**	-0.006**	0.002**	0.010**
	(0.003)	(0.003)	(0.001)	(0.004)
Extroversion	0.003	0.002	-0.000	-0.004
	(0.003)	(0.003)	(0.000)	(0.006)
Agreeableness	0.005	0.006	-0.000	-0.009
	(0.004)	(0.004)	(0.000)	(0.006)
Neuroticism	-0.003	-0.003	0.000	0.005
	(0.003)	(0.003)	(0.000)	(0.004)
Openness	-0.005	-0.006	0.000	0.009
	(0.004)	(0.004)	(0.000)	(0.009)
Log Likelihood -2781.15				
Prob> chi2 = 0.0000				

NOTE: *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

influence upon female attainment but is significantly associated with low levels of education for males, reducing the probability of having a higher education qualification by around four percentage-points. Conscientiousness is associated with female educational attainment although its effect is small, with the probability of holding a degree increased by one percentage points where this trait is present, a result which is statistically significant but never significant for males.

Finally, we examine the estimates from our wage model with ordered probit selection on educational attainment. This framework is used to examine if personality characteristics affect the wage once we control for their influence on the level of education achieved. The results for the personality characteristics are reported in tables 7 and 8 below. We can clearly see that once the effect of personality characteristics on educational attainment is controlled for there is little effect of the characteristics on the wage. This is a very different result to our second wage equations (column 2 of tables 3 and 4). The only significant finding for males is that having an extrovert personality increases the wage for those with a higher education qualification, although in the ordered probit of attainment this trait is actually associated with low educational attainment. For females who tend to have a high external locus of control, that is no

Table: 7 Ordered probit selection model: Males

	Effect of personality on wages selection on NVQ level			
N= 1377	NVQ Level 1	NVQ Level 2	NVQ Level 3	NVQ Level 4+
Internal locus of control	0.023	0.035*	0.001	0.038
	(0.020)	(0.019)	(0.034)	(0.024)
External locus of control	-0.017	-0.041**	-0.033	-0.030
	(0.018)	(0.017)	(0.042)	(0.025)
Challenge	0.017	0.024	0.119***	-0.009
	(0.018)	(0.018)	(0.038)	(0.022)
Affiliation	-0.053**	-0.045**	-0.068*	-0.028
	(0.023)	(0.021)	(0.040)	(0.023)
Conscientiousness	-0.063***	0.024	0.019	-0.003
	(0.020)	(0.018)	(0.033)	(0.021)
Extroversion	0.024	-0.004	-0.019	0.047***
	(0.018)	(0.017)	(0.033)	(0.019)
Agreeableness	-0.036	0.016	0.039	0.010
	(0.024)	(0.022)	(0.041)	(0.027)
Neuroticism	0.011	-0.013	-0.031	-0.020
	(0.018)	(0.015)	(0.027)	(0.016)
Openness	-0.019	0.019	-0.066*	0.010
	(0.022)	(0.024)	(0.040)	(0.025)

Table: 8 Ordered probit selection model: Females

	Effect of personality on wages selection on NVQ level			
N= 1106	NVQ Level 1	NVQ Level 2	NVQ Level 3	NVQ Level 4+
Internal locus of control	0.051**	0.040	0.144***	0.030
	(0.021)	(0.028)	(0.041)	(0.023)
External locus of control	-0.027	0.000	-0.030	-0.064***
	(0.019)	(0.023)	(0.044)	(0.025)
Challenge	0.018	0.016	0.010	0.029
	(0.020)	(0.021)	(0.031)	(0.022)
Affiliation	-0.091***	-0.018	-0.025	0.000
	(0.025)	(0.026)	(0.041)	(0.026)
Conscientiousness	0.022	0.057***	0.109***	0.076
	(0.016)	(0.017)	(0.027)	(0.024)
Extroversion	0.015	-0.023	-0.048	-0.016
	(0.020)	(0.019)	(0.033)	(0.019)
Agreeableness	-0.007	-0.030	0.047	-0.020
	(0.024)	(0.024)	(0.041)	(0.023)
Neuroticism	0.003	-0.047***	0.000	-0.017
	(0.015)	(0.018)	(0.027)	(0.014)
Openness	0.038	0.019	0.015	0.013
	(0.027)	(0.026)	(0.052)	(0.023)

self- belief that they are able to be successful, there is a negative effect on the wage; this trait also being associated with a probability of gaining only a low level of education.

5. Conclusion

We have attempted to estimate, ,for the first time, the effect on educational attainment and labour market outcomes of the complete set of nine personality characteristics examined by investigators in this field, which are assumed to be stable from age sixteen into adulthood. We have shown that personality characteristics, even if one controls for innate ability and other contextual factors more emphasised by the economics literature,, play a large part in success in the university context and thence in the labour market. We have estimated these pathways of impact by means of ordered probits of attainment and standard Mincerian wage functions, augmented by the nine personality

factors for which we wish to test. Holding constant the standard independent variables in this specification, we find, first, that the effects of external locus of control are negative, and second, that the influence of the extrovert-introvert dimension of personality is gender-specific, with males with extrovert personalities having a significantly reduced probability of gaining degree level education, but within the labour market males are rewarded for this characteristic. Whilst our measure of innate ability, test scores exerts a significantly positive influence on attainment, the influence from some of our personality variables is greater. Thus we expect individuals entering higher education to possess a high level of basic ability but with varying personality characteristics across the cohort, which appear on our analysis to have a determining influence on performance. Moreover, it may be possible to incentivise some of these positive personality traits, for example by making students aware of how they can play to their strengths and convert these positive psychological characteristics into improved grades. This suggestion leaves open, of course, the question of how it may be possible for specific actions, for example in the field of mentoring and in the field of incentive systems to improve performance, and the findings reported here suggest that this territory should be an important part of the agenda for future research. In particular, we believe that it draws attention to important avenues needing to be explored by decision-makers within the higher education sector.

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