The relative economic importance of academic, psychological and behavioural attributes developed in childhood.

Leon Feinstein *

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Abstract

This paper uses information about the psychological and behavioural development of children by ten in the 1970 Cohort to predict qualifications, employment and earnings. This previously unobserved individual heterogeneity has very substantial implications for the labour market. Different age ten abilities and attributes have implications for different adult outcomes. Age ten conduct disorder predicts male adult unemployment particularly well but it is self-esteem that predicts male earnings. For women the 'locus of control' is important. Omission of psychological and behavioural capital leads to an upward bias of the return to education, although this bias is not significant in these data.

It is well known that the observed academic ability of school children is associated with subsequent earnings even conditioning for qualifications obtained. Only recently, however, have economists begun to address the importance of what has been called 'psychological capital' for productivity and hence wages and this research is still at a very early stage. There has, as yet, been no longitudinal investigation of the relative importance of the academic and non-academic abilities developed in childhood for subsequent economic outcomes including wages.

This paper considers a wide range of assessments of the abilities that children have already developed by age ten and uses a sequential analysis to investigate the importance these different aspects of age ten ability have for subsequent economic success. The paper explores how this

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process differs for children of different social backgrounds and assesses the role of this wider set of abilities and attributes as channels for the intergenerational transmission of education and earnings. By showing that measures of psychological and behavioural attributes provide important signals about future economic outcomes, the paper suggests that there are public externality costs to schooling that under-values these aspects of development. The paper also makes use of the age ten scores to show differences in the processes of human capital formation on the one hand and the development of individual productivity on the other.

The data come from the 1970 British Cohort Study (BCS). This is a longitudinal study of all the children born in the UK in the first week of April 1970 and surveyed again in 1975, 1980, 1986, 1991 and 1996. Particular use is made of the 1980 Child Health and Education Study (CHES) and 1996 sweeps. At age ten, under the supervision of the Department of Child Health at Bristol University, the children were tested for standard maths and reading ability but also for the psychological attributes of self-esteem and locus of control described below and for the behavioural attributes of conduct disorder, peer relations, attentiveness and extraversion. Age twenty-six information is then available on highest qualification attained, earnings and periods of unemployment.

The first section describes the methodology and data. The second considers the importance of age ten attributes and abilities for subsequent educational progress, the third for labour market outcomes. Having established their importance, the fourth section considers the production of the age ten abilities themselves and concludes.

1. Data

1.1. The psychological and academic test scores

There has been substantial scepticism about the use of subjective data in economics. Goldsmith *et al*. [1997] ascribe this to doubts about valid measurement or interpersonal comparison

and to a lack of familiarity with psychological testing. However, psychologists are less cautious about such testing and have established strong links between psychological test scores and subsequent outcomes such as schooling achievements (Purkey, 1970, Thomas, 1973, Keltikangas-Jarvinen, 1992), criminality (McKinney *et al.*, 1978) or psychiatric disorders (Rutter *et al.*, 1970). The causal relations, however, are unclear and may remain so. As the psychiatrist Rutter [1970] argues in the context of a relation between his score for anti-social behaviour and subsequent educational failure, both may be a response to similar, unidentified, underlying deviance. There is also, clearly, two-way causality between educational ability and psychological attributes such as self-esteem. However, the first objective must be to test whether the scores carry information about labour market outcomes or not. If the psychological scores are not genuinely measuring the conceptual ability for which psychologists have developed them, it then remains for critics to explain what is actually being identified. This paper is concerned to establish their predictive power and so enable an initial assessment of the degree of previously omitted individual heterogeneity.

It is important, however, to be as clear as possible about what is being tested and there are a number of well-established guidelines in the psychological literature. Tests for a particular psychological attribute must give similar results to other tests for that attribute (convergence). Responses to individual items within the test must be highly correlated (reliability). There is a third requirement of good discrimination between children. Finally, there is the requirement of re-test stability. These requirements are met by the psychological tests developed by the CHES[1]. Summary statistics for the tests are given in Table 1.

[1] See Butler *et al*. [1982]

Table 1. Age ten abilities and attributes

Variable	Obs	Mean	Sd	Min	Max	Percentiles: 20th	80th	20/80 range
Academic scores								
Maths	11719	0	1	-3.43	2.22	-0.81	0.87	1.68
Reading	12790	0	1	-2.91	1.92	-0.98	0.95	1.93
Psychological scores								
Locus of control (CAROLOC)	12444	0	1	-2.64	2.72	-0.97	1.05	2.02
Self-esteem (LAWSEQ)	12519	0	1	-2.93	1.87	-0.93	1.07	2.00
Behavioural scores								
Anti-social behaviour (RUTTER)	12757	0	1	-1.51	4.39	-0.81	0.69	1.50
Peer relations	12757	0	1	-3.45	2.02	-0.83	0.92	1.75
Attentiveness	12757	0	1	-2.93	1.78	-0.95	0.96	1.91
Extraversion	12757	0	1	-3.07	2.11	-0.85	0.91	1.76

The use of academic ability scores now has a long history in labour economics so little more need be added here. The maths test was created by the Department of Child Health, Bristol University who supervised the surveys in 1975 and 1980. The reading test is the Edinburgh Reading Test. Both show good properties of discrimination without censoring although there is some bunching at zero for the maths score.

1.1.1. Psychological capital; self-esteem and the locus of control

The CAROLOC score for the locus of control (Gammage, 1975) and the LAWSEQ self-esteem score (Lawrence, 1973, 1978) are both based on childrens' responses. Scores satisfy the requirements of re-test stability, reliability, discrimination and convergence to similar test frameworks[2].

Self-esteem can be regarded as a fairly well-established notion (at least outside the psychological literature where it is more problematic). Lawrence [1981], who developed the test

[2] The LAWSEQ score has been shown to have a four month re-test corelation of 0.64 and a high correlation with the Coopersmith Self-esteem inventory (r=0.73). See Hart [1985] for these and other tests of the performance of the LAWSEQ scale. The Caraloc test of the CHES closely mirrors the locus of control test of Nowicki and Strickland [1973]. It was initially piloted on 800 children and tested for reliability, uniqueness and discrimination.

used here, has defined self-esteem as "the child's affective evaluation of the sum total of his or her characteristics both mental and physical." Brockner [1988] reports that managers perceive workers with high self-esteem to have higher productivity in work as a result of using time more effectively, requiring less guidance and considering a wider range of solutions to problems. Self-esteem should, therefore, increase wages directly. It might also lead to a higher probability of employment if job searchers are more confident in interviews.

The locus of control is, perhaps, a more vague notion referring to an individual's sense of control of their own destiny. Rotter [1954] isolates four aspects of this sense of self. Individuals with a high locus of control are better able to process information from the outside world, are concerned to improve both their circumstances and themselves and, finally, are more stable in response to external influences. It might be expected that such individuals will make better decisions about educational and career choices and have a higher degree of patience.

In a rare paper considering psychological capital in the field of economics, Goldsmith *et al.* [1997] observe self-esteem concurrently with wages at two dates using the NSLY. They estimate both simultaneously using the locus of control score as an instrument for self-esteem in the wage equation. This approach has the virtue of recognising the reverse causality between earnings and self-esteem but relies on a fairly dubious exclusion restriction. The assumption is that self-esteem is the more unstable of the two aspects of the individual's psychology and that the locus of control is well-established by adulthood, unlikely to change but a good predictor of the more time-variant variable, self-esteem. Although Goldsmith *et al.* refer to psychologists to support this assertion it is equally possible to find psychologists who would resist it. Goldsmith *et al.* follow Rosenberg [1965] who treats self-esteem as a relatively unstable feature of personality rather than a permanent trait. However, Coopersmith [1967] views self-esteem as fairly stable after an individual is seven to ten years old. Damon and Hart [1982] suggest that locus of control will influence choices (and hence

earnings) not solely through self-esteem but also directly. Shavelson and March [1986] discuss the difficulties of distinguishing the two notions empirically.

Rather than making strong psychological identification assumptions, this study will investigate the relative predictive power of the two test scores. Although they are clearly related, Gamage [1982], who developed the score used here, argues strongly against the idea of equating self-esteem and locus of control. In fact, the Goldsmith *et al*. exclusion restriction is rejected by the data presented here. This study finds that the two variables have different predictive properties for different variables of interest and for different groups of the sample. A further advantage of the current study is that we test the relative influence of these psychological variables on education and unemployment as well as on earnings.

1.1.2. Behavioural scores; Anti-social behaviour, peer relations, attentiveness and extraversion.

The Rutter score for anti-social behaviour (Rutter, 1967) is based on the responses of class teachers to questions about conduct disorder such as whether children bully, tease or quarrel with other children. It has been found to predict ratings based on a standard psychiatric assessment and children with a high score have been found to be at risk of psychiatric deviancy[3]. The other behavioural scores are also based on teachers' responses, hypothesised by CHES to indicate aspects of children's behaviour, taken from particular items of the behaviour scales developed by Rutter [1967] and Conners [1969]. Each score is the standardised result of principal components analysis conducted on individual items, described in more detail in Osborn & Milbank [1987].

[3] It has also been found to have a re-test reliablity over a two-month interval with a product-moment correlation, +0.89 and a reliability for re-testing by a different set of teachers after two months with correlation, 0.72, see Rutter [1967].

As stated above, anti-social behavior may be both the result and the cause of educational failure. The interest here, however, is particularly in how age ten social/anti-social behaviour predicts employment outcomes. Are children who are well behaved more likely to find work, either through increased desire to do so or better social skills? It may be that some underlying psychological issue is the root cause of behaviour and employability but a positive correlation between them would clearly signal the economic importance of assessing and confronting childhood behavioural problems. In fact, some work in the psychiatric and sociological literature has already concluded that conduct disorder is likely to predict problems in entry to the labour market, seen as a crucial threshold in adolescent development (Caspi *et al.*, [1998], Sanford *et al.*, [1993]). However, these studies have not considered wages and do not have the range of scores available in these data[4].

The peer relations and extraversion scores are interesting because of recent concern about the importance of "key skills" in the workplace. The importance of good communication and the ability to work in teams is being increasingly recognised (e.g. CBI, 1995, DfEE and Cabinet Office, 1996.) Attentiveness is obviously important for the development of human capital but it may also be that children who do not intend to stay at school or do not have high expectations of success are already beginning to pay less attention by age ten. The attentiveness variable might have implications, therefore, not just for educational development but also as a proxy for the student's interest in education.

Table 2 shows that the maths and reading scores are strongly correlated. Attentiveness and locus of control are also well correlated with the academic scores. There is less association of self-esteem or anti-social behaviour with age ten academic ability. Self-esteem is moderately correlated with locus of control but not particularly with the other behaviour scores.

[4] My thanks are due to Barbara Maugham of the Institute of Psychiatry for introducing me to this literature.

Table 2. Correlation coefficients amongst age 10 attribute variables.

	Maths	Reading	Loc. of C	Self-est.	Anti-soc.	Peers	Attentive
Maths	1.00						
Reading	0.74	1.00					
Loc. of C	0.40	0.41	1.00				
Self-est.	0.20	0.19	0.44	1.00			
Anti-soc	-0.20	-0.23	-0.11	-0.14	1.00		
Peers	0.23	0.24	0.19	0.20	-0.39	1.00	
Attentive	0.50	0.54	0.31	0.20	-0.55	0.48	1.00
Extravert	0.09	0.10	0.10	0.05	0.19	0.42	0.10

We will consider the determination of the age ten scores in the concluding section, having established their importance. However, it is worth pointing out here that all the age ten scores are strongly associated with social class, signed as one would expect. This might be the result of psychological production in the home due to easier material circumstances or the particular child-rearing abilities or aspirations of middle class families. Alternatively and less substantively, this might merely reflect the higher confidence of middle class children in educational environments or the prejudices of teachers. Because a wide-range of indicators of social class are observed, regressions can control for biases that might result from teacher prejudice.

In conclusion, the non-academic scores clearly provide information about the development of children that is associated with academic scores but not collinear with them. The scores also show the propensity to channel inter-generational social capital.

1.2. The Outcome variables

Section 2 considers the predictive power of the age ten scores for three sets of outcomes. The first outcome variable is educational progress assessed as the achievement of the three levels of qualifications shown in Table 3.

Table 3. Outcome variables in the BCS

Outcome	Mean	s.d.	obs	min	max
Educational Qualifications					
At least one O'Level	0.77	0.42	8422	0	1
At least one A' Level	0.36	0.48	8422	0	1
Degree	0.21	0.40	8422	0	1
Labour market					
Unemployment	0.30	0.46	8678	0	1
Long-term unemployment	0.39	0.49	2581	0	1
Earnings at 26: log, net, hourly wage	1.57	0.38	6080	0	4.61

Notes: The three educational qualifications are not exclusive. Children with a positive outcome for degree will also have positive outcomes for the O' and A'Level dummy variables.

The labour market outcomes considered are unemployment probabilities and hourly wages. It is expected that these outcomes may be more strongly correlated with the psychological and behavioural scores than are the educational outcomes since, although, productivity should be rewarded in the labour market, it is hypothesised that educational progress is more closely linked to academic ability than is market productivity. Hence, it should also be the case that the predictive power of academic scores will be less for the market than for the educational outcomes.

It can be shown that the BCS earnings data matches that of the LFS for 1996 by gender and qualifications and can be taken, therefore, to be a reliable measure of wages[5]. Sample members are, however, at an early stage of the age-earnings trajectory. Given that, as is well known, the slope of the average wage profile increases with education, returns to education and possibly age ten attributes might, if anything, be biased downwards.

The unemployment variable is derived from a job history variable generously provided by the CLS[6], broadly indicating length of longest period of unemployment. I have coded the unemployment variable to take the following values: 0=continuously employed or unemployed only intermittently and never for more than four months, 1=longest period of unemployment more than

[5] Feinstein [2000]

four months. Individuals who have never been employed are dropped. The long-term unemployed are defined here in the form of a conditional expectation, namely those who have experienced unemployment of more than four months duration for whom that unemployment has also been of over one year's duration. Although this truncates those individuals who have not experienced any substantial unemployment, the intention is to examine the power of age ten attributes to differentiate individuals at risk of long-term unemployment from those whose unemployment is not so likely to be long-lasting[7]. As discussed in Section 3.1, the relative values and significance of parameters in the analysis are reasonably robust to different transformations of these unemployment probabilities.

2. The association of age ten abilities and attributes with educational progress

Table 4 reports marginal effects from probit regressions of minimum educational qualification, O'Level, A'Level and Degree, on age ten abilities and attributes, controlling for gender.

Academic ability is the most important age ten predictor of subsequent educational qualifications. Since the ability scores are scaled with standard deviation equal to one, it can be observed, for example, that an increase of one standard deviation in reading ability is associated with a 9.5% increase in the individual's likelihood of gaining at least one O'Level.

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[6] This variable was derived by Pierella Paci at the Centre for Longitudinal Studies, Institute of Education. See Bynner *et al*. [1997].

[7] An alternative coding would be a variable that ranged from 1-5, increasing in the banded lengths of unemployment durations. Ordered probit regression on this variable would estimate coefficients that were the same for each unemployment grouping probability. Instead, the procedure adopted loses information by dropping individuals who have not been unemployed but simplifies the estimation process and allows particular age ten scores to influence the long-term unemployment probability without influencing the short-term probability.

Table 4. Age ten attributes and abilities as predictors of minimum educational qualifications, marginal effects from probit regressions.

	O'Level		A'Level		Degree	
	dF/dx *100	(S.E.) *100	dF/dx *100	(S.E.) *100	dF/dx *100	(S.E.) *100
Girl	2.73	(1.1)	-0.97	(1.4)	-2.23	(1.0)
Maths	7.19	(0.8)	12.45	(1.1)	8.55	(0.8)
Reading	9.42	(0.8)	12.43	(1.1)	7.63	(0.8)
Locus of Control	2.88	(0.6)	4.30	(0.8)	2.88	(0.6)
Self-esteem	1.19	(0.6)	1.14	(0.7)	0.30	(0.5)
Anti-social	-0.08	(0.7)	-0.89	(1.0)	0.11	(0.8)
Peer relations	-1.21	(0.7)	-1.46	(0.9)	-1.39	(0.6)
Attentiveness	6.19	(0.8)	8.40	(1.1)	6.07	(0.8)
Extraversion	-0.78	(0.6)	-1.38	(0.8)	-0.06	(0.6)
Observed Probability	0.77		0.35		0.20	
Observations	5968		5992		5979	
Pseudo R-squared	0.22		0.21		0.21	

Notes: Parameters and standard errors are multiplied by 100 to give percentage increase in probability of getting qualification for one standard error change in age ten score. As well as the variables listed, a control variable is introduced for children assessed as being in the special educational category in the medical examination file. This is never significant once age ten scores are also introduced.

The locus of control is a significant predictor of academic progress, unlike self-esteem. Attentiveness is particularly important. An increase in attentiveness of one standard deviation is associated with a 6% increase in the O'Level probability and a similar increase in the probability of getting a degree[8]. Going from the 20th decile of attentiveness to the 80th adds 16% to the probability of getting an A'Level and in terms of locus of control, children at the 80th percentile are 9% more likely to get an A'Level than children at the 20th percentile.

Background variables are introduced in Table 5. This addresses the questions of how much significant human capital has been accumulated by age ten and how future educational attainments

[8] These regressions were run across gender. If two separate models are estimated the only significant change is that maths is more important for boys than for girls as a predictor of the A'level and degree probability (at 1%). The marginal effects for boys are 14.3% and 10.2% as opposed to 10.4% and 7.4% for girls.

are then influenced by background factors. Occupational classification (SES), parental education, average weekly income, parental interest in education, SES of grand-parents and ethnicity are all assessed when the sample children were ten years old and are standard background variables in regressions of this kind[9]. We condition, here, not just on SES1 but on dummy variables for all SES groups. Similarly fine specifications are introduced for parental education and grand-fathers' SES. The "general family background" set of controls includes the number of older and younger children, parental interest in education, mother's age, absent parents and a dummy variable on being in a residential home.

The maths and reading score parameters fall significantly in the three regressions but still carry considerable additional forecast information. In the underlying data, only 35% of children in the bottom quintile of age ten reading scores, for example, are predicted to get even one O'Level or CSE equivalent as compared with 95% of top quintile children. Thus, even knowing about the family background of children, performance by age ten is crucial for further development[10].

Moreover, non-academic scores at age ten also still provide predictive power. These scores, in particular attentiveness and locus of control, are not simply proxies for background effects, although they are, to some extent, channels for them[11]. Family background, however, is still

[9] See Haveman and Wolfe [1995] for a summary, Leslie and Drinkwater [1999] for a recent consideration of the staying-on rates of ethnic minorities in the UK and Hill and O'Neill [1994] for an analysis of third-generation effects.

[10] The equivalent A'level probabilities are 4% for the bottom quintile and 62% for those in the top reading quintile by age ten. The degree probabilities are 1% and 41%.

[11] That they are channels can be observed from the fact that with no age ten scores entered the marginal effect of having a father in SES1 on the O'Level probability is 16.2 (standard error, 1.8). When age ten scores are entered this falls to 9.5 (standard error, 2.4), a change significant at 1%. Even when only non-academic age ten scores (i.e. those other than maths and reading) are entered this falls to 12.9 (standard error, 2.0), a change also

a strong predictor of educational progress, even given age ten ability. SES matters but parental education has a still more substantial effect. Having a mother with a degree adds 11, 24 and 20 percentage points to the probabilities of attaining an O'Level, A'level and degree, respectively, controlling for the age ten scores and all background variables. These are very large magnitudes, roughly equivalent to four standard deviations gain in maths ability for the degree probability of the sample child.

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significant at 1%. The reductions in the association of SES1 with A'Level and degree probabilities when all age ten scores or only non-academic abilities are included are also significant at 1%.

Table 5. Probit regression of minimum educational qualifications on family background, and age ten attributes and abilities.

	O'Level dF/dx *100	(S.E.) *100	A'Level dF/dx *100	(S.E.) *100	Degree dF/dx *100	(S.E.) *100
Maths	5.60	(0.8)	9.79	(1.2)	5.81	(0.7)
Reading	7.64	(0.8)	10.34	(1.2)	5.21	(0.8)
Locus of Control	2.51	(0.6)	4.12	(0.8)	2.28	(0.5)
Self-esteem	0.64	(0.5)	0.18	(0.8)	-0.35	(0.5)
Anti-social	0.51	(0.7)	0.07	(1.1)	0.68	(0.7)
Peer relations	-1.00	(0.7)	-1.14	(0.9)	-0.98	(0.6)
Attentiveness	5.50	(0.7)	7.73	(1.1)	5.26	(0.7)
Extraversion	-1.08	(0.6)	-2.33	(0.9)	-0.41	(0.5)
Selected other variables						
Girl	2.91	(1.0)	-0.24	(1.4)	-2.46	(0.9)
Number of older siblings	-2.11	(0.5)	-3.36	(0.8)	-2.11	(0.5)
Income (£100)	2.17	(1.1)	3.88	(1.4)	2.67	(0.8)
Mother's age	0.40	(0.1)	0.84	(0.2)	0.63	(0.1)
West-Indian parents	12.11	(1.5)	42.60	(7.3)	24.56	(10.5)
Asian parents	14.32	(0.9)	46.66	(6.2)	35.00	(8.2)
Father SES1	7.13	(2.9)	17.99	(6.9)	12.89	(7.0)
Mother O'level/vocational	4.27	(1.2)	7.86	(1.8)	6.05	(1.2)
Mother A'Level	5.43	(2.0)	12.01	(3.2)	12.47	(2.6)
Mother degree	10.69	(2.8)	24.37	(6.0)	20.16	(4.7)
Father O'level/vocational	-0.96	(1.3)	2.38	(1.9)	1.32	(1.3)
Father A'Level	3.12	(1.9)	1.42	(2.8)	1.06	(1.8)
Father degree	2.95	(2.5)	14.50	(3.4)	6.36	(2.3)
Mother's father SES1	3.13	(4.3)	13.78	(6.5)	11.67	(5.1)
Father's father SES1	7.45	(3.8)	6.26	(6.4)	2.26	(3.8)
P-value of control variables						
General family background		0.000		0.000		0.000
Ethnicity		0.000		0.000		0.000
Father's SES		0.040		0.000		0.007
Mother's SES		0.040		0.003		0.054
Mother's quals		0.001		0.000		0.000
Father's quals		0.123		0.000		0.008
Mother's father's SES		0.854		0.170		0.000
Father's father's SES		0.095		0.011		0.330
Region		0.000		0.000		0.444
Observations	5968		5992		5979	
R-squared	0.27		0.30		0.33	

Notes: When either parent was absent parental variables were set at zero and dummy variables were introduced as a control. Missing values are set to the variable's average value and indicated by a 0/1 control variable. This reduces standard errors. Parameter estimates for these dummy variables are not reported but do not have large or significant effects on results.

The "general family background" set of controls is the number of older and younger children, parental interest in education, mother's age, absent parents and a dummy variable on being in a residential home.

The education of the father is also important, although less so than that of the mother. A child whose parents are both educated to degree level is 39 points more likely to get at least one A'Level than a child with the same level of age ten ability but whose parents do not have any qualifications.

It is striking (though a standard finding) that when we condition for age ten ability, children of West-Indian parents are much more likely to gain qualifications than are children from the ethnic majority. In the raw data, West-Indian children are nearly six points less likely than the default group to get a degree but twenty-five points more likely to get a degree, once we control for age ten ability[12]. More generally, given their age ten performance children from all ethnic minorities are more likely to stay on and do well at school than children from the ethnic majority. This might reflect extra pressure for children to gain qualifications to overcome discrimination or poor contacts in the labour market or, alternatively, a higher degree of educational culture within families. It also suggests that ethnic educational inequality begins in primary school or earlier.

Another interesting feature of these data is that we have information not just on the occupational classification (SES) of fathers but also of paternal and maternal grandfathers. This enables us to identify effects across three generations. Children whose maternal grandfather was in SES 1 are twelve points more likely to get a degree than other children of the same age ten ability. This is significant at 1% and equivalent to two standard errors of age ten maths ability. It is interesting that it is the effect of the mother's father that dominates for the A'Level and degree choices, counter to simple explanations by genetic endowment. The difference between parameters on the two grandfathers is, however, not significant.

[12] This is not an artefact of conditioning on the other background variables but can be reproduced by conditioning solely on age ten reading and maths scores. It is not due, therefore, to the fact that parental education is commonly not observed for ethnic minority parents.

Overall, then, although the age ten test scores are important predictors of subsequent educational attainment family background continues to play an important role through a number of channels. Children from more wealthy, more educated and professional families are more likely to progress academically, even given their age ten academic ability. As we see below in Section 3 this is a different picture to that for the inter-generational transmission of wages.

3. Labour market outcomes

3.1. Age ten scores and employment at age twenty-six

Discounting any initial unemployment in the three months after leaving full-time education, 35% of the twenty-six year olds in this survey had been in continuous employment since leaving education. A further 35% had experienced intermittent unemployment, the remainder having experienced spells of unemployment of over four months duration. Table 6 reports marginal effects of the age ten scores in predicting unemployment probabilities. Although we have omitted family and background variables they do not change the results in any substantive way. In line with the sequential methodology, we should also omit qualifications as they are obtained after the age ten scores. However, we include them to counter the observation that test scores might only be important for unemployment probabilities because of their implications for qualifications attained. Results, however, are robust to the exclusion of qualifications.

Table 6. Probit regression of unemployment duration variables on age ten attributes and abilities.

	Males				Females			
	(1) Unemployed > 4 months		(2) Unemployed > 12 months if column(1)=1		(3) Unemployed > 4 months		(4) Unemployed > 12 months if column(1)=1	
	Coef. *100	(S.E.) *100	Coef. *100	(S.E.) *100	Coef. *100	(S.E.) *100	Coef. *100	(S.E.) *100
Maths	-3.68	(1.6)	-2.05	(3.2)	-4.17	(1.3)	-3.63	(3.4)
Reading	0.66	(1.6)	-3.54	(3.2)	1.63	(1.3)	0.77	(3.1)
Locus of Control	0.47	(1.2)	3.88	(2.4)	-1.23	(1.0)	-5.00	(2.5)
Self-esteem	-0.83	(1.1)	-4.52	(2.3)	-1.53	(0.9)	6.19	(2.2)
Anti-social	4.14	(1.3)	-2.11	(2.6)	-0.05	(1.2)	3.66	(2.9)
Peer relations	-1.79	(1.2)	-3.49	(2.5)	-2.85	(1.1)	1.51	(2.8)
Attentiveness	-1.24	(1.4)	-0.59	(2.8)	-2.90	(1.3)	-3.39	(3.1)
Extraversion	-3.41	(1.2)	2.25	(2.3)	-0.19	(1.0)	-1.16	(2.5)
At least one O'Level	-6.75	(2.6)	-17.93	(4.9)	-8.97	(2.3)	-13.73	(5.1)
At least one A'Level	-2.74	(3.1)	2.18	(7.0)	-6.59	(2.3)	-12.18	(6.7)
Degree	9.22	(3.5)	-13.58	(6.6)	13.49	(3.3)	4.55	(8.6)
Observed probability		0.32		0.39		0.25		0.38
Pseudo R-squared		0.07		0.12		0.08		0.13
Observations		2604		789		3187		733

Notes: See discussion of Table 3 for the precise derivation of the dependent variable. As well as the specified variables controls are also introduced for the 123 age ten Local Education Areas. Parameters and standard errors are multiplied by 100 as in previous tables.

The anti-social behaviour score is as strong a predictor of male unemployment as the maths score (and more precise). Going from the 20th to 80th percentile of the anti-social disorder range adds 6% to the likelihood of experiencing an episode of unemployment of more than four months. This is roughly equivalent to the effect of getting at least one O'Level and might reflect influences of behaviour on success in interviews or be the result of the underlying disaffection that turns the individual away from labour market activities, making him both less attractive to employers and less interested. It might also be that boys who were anti-social at age ten have higher entry rates to unemployment later on. In fact, we observe in column (2) that, within the group of those who have experienced a significant spell of unemployment, boys who were anti-social are not more likely to

suffer a very long-term spell of unemployment. This supports the suggestion that boys with high anti-social scores are getting jobs and then losing them.

Second, extrovert boys are much less likely to experience unemployment, again with substantial range effects. Third, anti-social behaviour and introversion are not strong predictors of shorter-term female unemployment which depends more on poor peer relations and inattentiveness. These effects may reflect a choice against paid work by individuals who are un-interested in school, their peers and labour force activity or they might indicate that it is harder for such individuals to find paid work.

For males, low self-esteem is a particularly strong indicator of the difference between those whose unemployment will be relatively short and those more likely to experience long-term unemployment. For those males who have been unemployed for more that four months, a standard error of self-esteem will reduce the probability of longer-term unemployment by 4.5%. The 20/80 range effect is 9%[13]. For girls, on the other hand, self-esteem is positively associated with long-term unemployment. Experiments with functional form, however, have shown that the finding is due to differences between the tails of the distribution. When we include dummy variables for the top or bottom decile of all eight scores we find that the self-esteem parameter is zero but that the marginal

[13] It should also be remembered that the unemployment variables are coded in the particular form described in the discussion to Table 3. Results, however, are reasonably robust to alternative codings. One such experiment was to code the unemployment variable to take a value of 0 for those who have been continously employed, 1 for those intermittently unemployed, 2 for those with a spell over four months, 3 for a spell of more than a year and 4 for a two year spell. An ordered probit regression then gives coefficients of 10.3 for the anti-social score (significant at 1%) and of -4.6 for self-esteem (significant at 10%). This maintains the broad pattern of the results given in Table 6 but loses some of the non-linearity that self-esteem is particularly important in distinguishing those able to emerge from shorter periods of unemployment from those perhaps more at risk of greater unemployment scaring.

effects are -27% (standard error, 5) for the lowest self-esteem decile and 43% (standard error, 11) for those in the highest decile. It may be, then, that for this group self-esteem gives the confidence to stay out of work longer[14].

3.2. Age ten scores and earnings at age twenty-six

We next address earnings. Whether or not we control for background variables, it can be seen in Table 7 that the age ten maths, reading and self-esteem scores strongly predict male market wages. In terms of the family background effects, the statistical effect of going from the 20th decile of self-esteem to the 80th is a 5.6% increase in the hourly wage. This very large effect is equivalent to that from increasing family income during childhood by £100 a week or moving from a family headed by a male with no qualifications to one with A'Levels or a degree.

[14] These unemployment effects will be better assessed when the more detailed information from the 1999 sweep becomes available.

Table 7. OLS regression of log wages on family background, and age ten attributes and abilities.

	Males				Females			
	Coeff *100	(S.E.) *100	Coeff *100	(S.E.) *100	Coeff *100	(S.E.) *100	Coeff *100	(S.E.) *100
Maths	3.76	(1.3)	3.10	(1.3)	5.77	(1.3)	4.91	(1.3)
Reading	4.00	(1.3)	2.87	(1.3)	4.05	(1.3)	3.18	(1.3)
Locus of Control	0.94	(1.0)	0.64	(1.0)	2.93	(0.9)	2.09	(0.9)
Self-esteem	3.15	(0.9)	2.78	(0.9)	1.22	(0.8)	0.93	(0.8)
Anti-social	-0.85	(1.1)	-0.78	(1.1)	2.77	(1.3)	3.00	(1.3)
Peer relations	0.62	(1.0)	0.51	(1.0)	2.52	(1.1)	2.69	(1.1)
Attentiveness	1.95	(1.2)	2.13	(1.2)	3.53	(1.3)	3.32	(1.3)
Extraversion	1.26	(0.9)	1.19	(0.9)	-0.55	(0.9)	-1.09	(0.9)
Selected other variables								
Number of older siblings			0.49	(0.8)			-0.68	(0.9)
Income (£100)			5.54	(1.6)			7.61	(1.5)
Mother's age			-0.12	(0.2)			0.13	(0.2)
West-Indian parents			0.73	(11.2)			23.78	(9.9)
Asian parents			11.28	(8.8)			4.20	(8.2)
Father SES1			11.00	(6.5)			6.90	(6.6)
Mother O'level/vocational			1.39	(2.0)			1.39	(1.9)
Mother A'Level			8.45	(3.5)			-2.42	(3.2)
Mother degree			0.17	(5.1)			9.26	(5.2)
Father O'level/vocational			3.92	(2.2)			-1.57	(2.1)
Father A'Level			4.04	(3.1)			-4.59	(3.0)
Father degree			6.77	(3.4)			-1.13	(3.4)
Mother's father SES1			-2.80	(6.2)			2.00	(5.9)
Father's father SES1			4.45	(6.3)			5.98	(7.1)
P-value of Control variables								
General family background				0.008				0.000
Ethnicity				0.307				0.283
Father's SES				0.290				0.553
Mother's SES				0.040				0.931
Mother's quals				0.101				0.123
Father's quals				0.179				0.496
Mother's father's SES				0.880				0.814
Father's father's SES				0.879				0.382
Region		0.000		0.000		0.000		0.000
Constant	169.1	(1.5)	151.0	(12.3)	158.2	(1.5)	138.6	(11.7)
Observations		2019		2019		2171		2171
R-squared		0.12		0.16		0.14		0.18

Notes: As in previous tables parameters are multiplied by 100 to give percentage returns for one standard deviation change in age ten score. Observations with unreported qualifications or family background are dropped. Absent parents or missing values were treated as in Table 5.

For female earnings, however, self-esteem does not play a significant role but the locus of control and behavioural scores are much more important. Controlling for parental background, the effect of going from 20th to 80th decile of attentiveness is a 6.3% increase in wages, the same as the 20/80 range effect for the reading distribution and roughly equivalent to £100 per week more family income during childhood. The range effect of increasing the peer relations score is also high at 5%. All of these results are robust to controlling for part-time working. It is interesting that the anti-social score enters positively for female wages, suggesting that teachers rate more motivated or ambitious girls as less "social." Thus, it may be that the underlying attributes assessed by the age ten scores have different labour market rewards for men and women but also that the underlying attributes are themselves gender-specific.

Taken together, Tables 6 and 7 strongly suggest that more attention might be paid to the non-academic behaviour and development of children as a means of identifying future difficulties and labour market opportunities. It also suggests that schooling ought not be assessed solely on the basis of the production of reading and maths ability. There might be economic returns to thinking more imaginatively about the role of schooling and the way schools interact with families and children in generating well-educated, productive but also well-rounded and confident individuals. We consider this issue in the concluding section below.

It is also important to note that the effect of the family background variables is much weaker for market productivity than for educational progress. There are a number of interesting differences. Family income plays a much more substantial role for wages than for education. Mother's education and grand-parents' social class is much less important although mother's degree does carry substantial weight for the prediction of daughters' wages. Children of older mothers are not predicted to earn more even though they are predicted to progress further educationally. The F-

statistic results in Table 7 show that fathers' qualifications or SES, ethnicity and grandfathers' SES are not significant sets of controls in the earnings equation although they were very important in the qualifications regressions in Table 5.

Future earnings appear, on this analysis, to be governed by a different set of factors than future educational progress which is influenced to a greater extent by family background factors that proxy the cultural environment of the child. Market productivity is not, therefore, the later correlate of education production, governed by the same factors, simply transferred to the labour market. This picture is supported by the fact that different age ten tests scores are important for predicting the two sets of achievements. For educational progress, the locus of control and attentiveness are particularly important. For income, peer relations and self-esteem plays a much greater role. Moreover, whereas anti-social behaviour is strongly associated with male unemployment probabilities, it plays little role for earnings.

I emphasise the distinction between productivity and the production of productivity in order to bring attention to the social and psychological complexity of each. Human capital is central to much endogenous growth theory, for example, as well as to the analysis of inequality. In modelling the relationship of human capital and growth rates, it may be useful to be more attentive to this complexity than has hitherto been possible.

3.3. The returns to education

From Table 8, below, it is apparent that a number of the age ten scores are important for wages even conditioning on qualifications.

Table 8. Wage equations with qualifications.

	Males		Females	
	Coef. *100	(S.E.) *100	Coef. *100	(S.E.) *100
Maths	1.96	(1.3)	3.69	(1.3)
Reading	2.46	(1.3)	1.34	(1.3)
Locus of Control	0.64	(0.9)	1.86	(0.9)
Self-esteem	2.86	(0.9)	1.01	(0.8)
Anti-social	-0.64	(1.1)	3.04	(1.3)
Peer relations	1.01	(1.0)	2.88	(1.0)
Attentiveness	0.72	(1.2)	2.34	(1.3)
Extraversion	1.28	(0.9)	-0.41	(0.9)
At least one O'Level	4.81	(2.1)	9.09	(2.3)
At least one A'Level	5.19	(2.3)	10.76	(2.1)
Degree	7.67	(2.6)	5.82	(2.4)
Pseudo R-squared		0.14		0.18
Observations		2019		2171

Notes: Coefficients and standard errors are multiplied by 100. Standard errors in brackets.

Conditioning on qualifications, self-esteem is the most quantitatively important age ten test score for male earnings. The estimate on locus of control for female earnings falls by more because of its strong association with educational progress but is still significant (at 5%) and of non-negligible magnitude. There does, therefore appear to be a return to locus of control for women in addition to the indirect benefit that it is associated with higher levels of education.

Omission of maths and reading scores leads to ability bias in estimates of the return to education. This is well-established (see, for example, Dearden [1998]). However because of the relatively low correlation of non-academic ability and qualifications, no significant bias arises from omission of the psychological and behavioural scores so long as academic ability is included[15].

[15] In our data, when no age ten scores are included, the returns to the three educational qualifications for males are 9.6%, 8.1% and 10.0% respectively, where returns to higher qualifications must be added to those already attained so that the degree return, for example, is 27.7%. These fall to 5.5%, 5.7% and a further 7.9% when the maths and reading scores are included. The degree return falls, therefore, to 19.1%. The test that the changes are not jointly significant is rejected at 5%. However, adding the other age ten scores only reduces the education

It might be argued that since age ten academic ability is measured with error, the non-academic variables are biased upwards. As a check of robustness, therefore, experiments have been made in which the intellectual ability scores are instrumented by earlier scores taken at age five. The maths and reading scores were replaced by a single ability measure, the British Ability Scale, a composite test of maths and reading, see Butler [1987]. This means that only one variable needed to be instrumented. The instruments were test scores from the earlier (1975), age five sweep of the data. There was some evidence that measurement error is important but only for the male wage equation. In neither case, however, was there any significant and substantive change in the important psychological or behavioural age ten scores[16].

4. Conclusions

This paper has found substantial labour market returns to non-academic human capital production. Although this does not in any way offset the importance of Government programmes to improve literacy and numeracy, it does suggest that there is a possible economic return to thinking more broadly about the benefits and possibilities of schooling.

To summarise, attentiveness in school has been shown to be a key aspect of human capital production, also influencing female wages even conditioning on qualifications. Boys with high level of

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returns to 4.9%, 5.1% and 7.6% and the test of no joint change is not rejected even at 20%. The parameters do, however, all fall in magnitude.

[16] F-statistics from regression of the instruments on the endogenous variable are, not surprisingly, very high, 45.0 and 30.6. Exclusion restrictions are also clearly satisfied with sargan tests of instruments on residuals of 0.925 for the male regression and 0.996 for the female wage equation. This is, again, not surprising given the plethora of age ten information. The self-esteem parameter for males is unchanged as were the locus of control and peer relations parameters for women. The attentiveness score becomes much smaller in the male wage equation but was in any case not significant at 5% in Table 7. The Hausman test t-statistic for change in instrumented variable is 2.3 for males, 0.5 for females.

conduct disorder are much more likely to experience unemployment but higher self-esteem will both reduce the likelihood of that unemployment lasting more than a year and, for all males, increase wages. The locus of control measure of psychological development is an important predictor of female wages reflecting, perhaps, the fact that the observed self-esteem of boys is higher than that of girls. This undermines the exclusion restriction of Goldsmith *et al*.. Good peer relations are important in the labour market, particularly for women, reducing the probability of unemployment and increasing female wages.

Given the implications of these observations for inequality and growth the question is whether or not Government-led interventions can influence how children develop in the ways assessed by these tests. The two main institutions for achieving this are, of course, families and schools, although peer groups and wider communities are important links and conditioning factors between these two. That parenting is the crucial arena for the development of the kind of human capital emphasised in this paper can be seen from Table 9 which reports ordinary least squares regressions of age ten scores on proxy measures of schooling and parenting quality.

Table 9. Estimation of age ten scores.

	Maths		Locus of control		Self-esteem		Conduct disorder	
	Est.	(s.e.)	Est.	(s.e.)	Est.	(s.e.)	Est.	(s.e.)
Girl	-0.09	(0.02)	-0.18	(0.02)	-0.24	(0.02)	-0.25	(0.02)
Schooling								
Good peers	0.15	(0.02)	0.03	(0.03)	0.01	(0.03)	-0.02	(0.03)
Bad peers	-0.20	(0.02)	-0.05	(0.02)	-0.03	(0.02)	0.06	(0.02)
No instructional reading	0.21	(0.04)	0.15	(0.04)	0.09	(0.04)	-0.19	(0.04)
No sport in curriculum	-0.16	(0.02)	-0.12	(0.02)	-0.12	(0.02)	-0.01	(0.02)
Parental attitudes								
Mother hostile	-0.18	(0.15)	-0.26	(0.17)	-0.41	(0.17)	1.48	(0.16)
Father hostile	-0.43	(0.18)	-0.36	(0.20)	-0.10	(0.20)	0.67	(0.19)
Father's interest in education	0.27	(0.06)	0.29	(0.07)	0.24	(0.07)	-0.40	(0.06)
Mother's interest in education	0.68	(0.05)	0.47	(0.06)	0.25	(0.06)	-0.59	(0.06)
Parental background								
No mother	-0.07	(0.11)	-0.08	(0.12)	-0.30	(0.12)	0.34	(0.12)
Number of siblings	-0.04	(0.01)	-0.03	(0.01)	-0.03	(0.01)	0.01	(0.01)
High SES	0.45	(0.05)	0.36	(0.05)	0.16	(0.06)	-0.03	(0.05)
Medium SES	0.21	(0.05)	0.20	(0.05)	0.06	(0.05)	-0.01	(0.05)
Mother O'level/vocational	0.18	(0.02)	0.15	(0.02)	0.06	(0.02)	0.00	(0.02)
Mother A'Level	0.38	(0.04)	0.27	(0.04)	0.09	(0.04)	-0.01	(0.04)
Mother degree	0.60	(0.06)	0.42	(0.07)	0.23	(0.07)	-0.10	(0.07)
Constant	-0.87	(0.07)	-0.67	(0.07)	-0.26	(0.07)	0.90	(0.07)
Observations	9699		9959		10017		10257	
R-squared	0.22		0.11		0.06		0.09	

Notes:

(i) Children at special educational institutions excluded.

(ii) Schooling and parental attitude variables reported by teachers. The parental interest variables range from 0 to 1

(iii) Good peer group is a dummy variable indicating children in classes that have a high proportion of parents in professional occupations, a low proportion of parents in manual occupations and a high proportion of children judged by te teacher to be of good academic standard. The bad peer group indicates the opposite environment.

The estimated model groups boys and girls which obscures important differences between genders in the influence of the background and schooling variables. Crucially, however, the broad findings are the same across gender. Firstly, explanation of the psychological and behavioural variables is even less than that of the maths score which is commonly shown to be poorly explained by observed inputs. The production of these aspects of human capital are even more random and subject to unobserved heterogeneity than is the production of academic ability. The very large effect of maternal hostility on conduct disorder and the insignificance of standard measures of SES and maternal education reflect the importance of only marginally systematic shocks to the development

of individuals, relevant to economic outcomes as has been shown but subject to very individual-specific environmental influences.

Second, the explanatory role of schooling variables is substantially less than that of measures of parental interest and hostility. Partly, this may be due to the point just made that influences on behaviour and psychological development are very proximal to the individual. School peer groups, which have substantive and significant associations with maths ability, play no role in explaining psychological development. However, even for maths, parental attitudes are substantively more important than peer groups[17].

Third, schooling does appear to matter. Standard measures of school quality such as class size and school expenditures are commonly shown not to be statistically significant predictors of educational outcomes. In Table 9, instead, aspects of curricula are introduced. Children at schools which emphasise non-instructional teaching of reading, emphasising instead creative reading or reading for pleasure can be seen to score better in all four scores. To an extent, this may reflect selection effects but regressions do control for peer groups. In fact, the results hold for models run only on children in good peer groups. This suggests that the way children are taught can make a difference to their general development as well as to the production of academic ability. Similarly, children at schools in which no sport was scheduled in the curriculum also score worse for maths

[17] Although results are presented for regressions grouped by gender there were a number of interesting distinctions. Particularly revealing was the fact that for every score except conduct disorder maternal interest was more important for girls than for boys and paternal interest less important. Thus for maths, for example, the highest level of father's interest increases boys' scores by 0.52 (s.e.: 0.11) and girls' scores by 0.15 (0.11). The highest level of mother's interest increases boys' scores by 0.73 (0.11) and girls' scores by 1.07 (0.10). The maternal interest parameter was significantly higher in girls' maths scores than in those of boys at 1%. The reverse was true for the paternal interest parameter, again at 1%.

and the psychological variables. The effect on maths scores emphasises the fact that selection effects are important here and that the curriculum variables are also proxy measures for unobserved school quality and neighbourhood. However, the results imply that what happens in school is important.

Traditionally, the school and the local area have commonly been seen as the environments most amenable to Government intervention. Most schooling is Government funded and much intervention to reduce the intergenerational transmission of poverty has been at the area level. Recently, however, the Government has emphasised early years as crucial and this has led to funding of the Sure-Start programme to support parenting skills. This is, in many ways, a new venture for Treasury-supported policy but the evidence of this paper is that there are perhaps more considerable returns to such funding if schemes can influence behavioural and psychological development as well as the academic ability of children. It is not obvious that parental hostility, for example, can be seriously influenced by (self-selected) parenting classes but interventions at the margins may make a difference and the programme will, at the very least, be an important step towards better understanding of mechanisms for positively influencing the formative experiences of children. The contribution of this paper is to show that the attempt may be worth making even in the purely economic terms of the Exchequer costs of unemployment or the generation of wealth.

Evidence has also been presented to suggest that different aspects of non-academic human capital are important for different labour market outcomes. For example, anti-social behaviour strongly predicts unemployment for males but self-esteem is more important for wages. Similarly, different academic abilities are important predictors for different groups of the population. Human capital is not, therefore, a single entity that develops along a single trajectory influencing every aspect of economic life. Skills and their production are much more diverse than this.

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