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Fernando Galindo-Rueda
Anna Vignoles

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Fernando Galindo-Rueda
CEP, London School of Economics,
University College London and IZA Bonn

Anna Vignoles
CEP, London School of Economics

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IZA

P.O. Box 7240
D-53072 Bonn
Germany

Tel.: +49-228-3894-0
Fax: +49-228-3894-210
Email: iza@iza.org

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ABSTRACT

Class Ridden or Meritocratic? An Economic Analysis of Recent Changes in Britain*

In a meritocratic society an individual's economic success is determined by their ability, not by their parents' socio-economic status. We assess whether meritocracy has increased in both the British education system and labour market. The richness of our longitudinal data enables us to look at the complex inter-relationship between social class, ability, education and labour market outcomes. In Britain the production of human capital (cognitive ability and education) has become less meritocratic and more influenced by social background. Whilst cognitive ability is an important determinant of labour market success, there is only mild support for an increase in its importance.

JEL Classification: I20, J31

Keywords: meritocracy, ability, human capital, social class, wages

Corresponding author:

Fernando Galindo-Rueda
Centre for Economic Performance
London School of Economics
Houghton Street
WC2A 2AE London
United Kingdom
Tel.: +44 20 7955 6974
Email: f.galindo-rueda@lse.ac.uk

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1 Introduction

A meritocratic society could be defined as one in which an individual's economic success and social status are determined by their own ability and effort, rather than by their parents' socio-economic status.[1] Indeed the notion of meritocracy is closely allied to the idea of equality of opportunity, which is championed by those from across the full range of the political spectrum (Arrow *et al* (2000)). Of course, a meritocratic society is not necessarily an equal society, since meritocracy is about equality of opportunity rather than equality of outcomes. Indeed a relatively unequal society (such as has emerged in the US and Britain in the last thirty years) is completely compatible with a wholly meritocratic one, if a high price is paid for ability, and if ability is very unequally distributed. Nonetheless the concept of meritocracy is generally used in a normative way, as an ideal to aspire to.[2] Indeed many of the economic reforms of recent decades, designed to liberalise markets and increase competitiveness, have been motivated by a desire to move towards a more productive and meritocratic society in which individuals succeed by their own ability and efforts.

Yet the political consensus in favour of a meritocratic society, with equality of opportunity for all, has been recently undermined, at least in the US. This is because of the growing belief that the poor, far from being the victims of discrimination and an unfair economic system, actually lack productive ability (Arrow *et al* (2000)). Crudely put, the argument is that the poor are unable to contribute to our society in an economic sense because they lack the ability to do so and therefore policies to improve equality of opportunity, that do not also boost the productive ability of the poor, are doomed to failure. This is essentially an empirical question about the changing relationship between ability and various socio-economic outcomes, especially education and earnings (Cawley *et al* (1996)). Until recently the literature has focused on whether changes in the importance of ability underlie observed patterns of wage differentials, as well as changes in the returns to commonly observed characteristics, such as education (Blackburn and Neumark

(1993); Murnane, Willet and Levy (1995); Grogger and Eide (1995); Hauser and Huang (1997); Cawley *et al* (1998a) Heckman and Vytlacil (2001)). Yet the determinants of cognitive ability, its relationship with educational attainment and its independent role in the labour market are still not well understood. For example, an individual's 'ability' is itself not completely free from potentially unmeritocratic influences. The cognitive ability and socio-economic status of a person's parents to some extent predicts an individual's own socio-economic status due to both genetic heritage and potentially unmeritocratic environmental factors.[3] Unpacking the determinants of cognitive ability, and its relationship with subsequent educational achievement and socio-economic success is therefore of crucial policy importance.

This paper uses British data to examine the determinants of cognitive ability, its role in the labour market, and how this has changed over time.[4] There are features of British society and its labour market that make our results of great interest to a broad readership, especially those interested in the US economy. Firstly, relative social mobility has historically been very similar in the US and the UK (Erickson and Goldthorpe (1985)). The caricature of Britain as a rigid, class-ridden society, compared to the more open and fluid US, is simply flawed. Furthermore, like the US, the UK has experienced substantial skill biased technological change in recent decades (Machin (1996,2001) and Machin and Van Reenen (1998)). Although the British education system has been expanded so that 45% of each cohort now enters university (exactly the same proportion as enters higher education in the United States (OECD 2001)), this expansion appears to have been insufficient to meet the increased demand for skill. A similar situation has occurred in the United States. This has lead to both higher returns to education and an increase in income inequality (Harkness and Machin (1999); Walker and Zhu (2001)). In addition the UK has experienced much economic reform during the last few decades. Labour and product markets have been de-regulated, privatisation has been extensive, the power of the unions has receded and, as said before, the education system expanded. Whether these extensive reforms have led to a more meritocratic society is obviously of great relevance to academics and policy-makers in a number of other developed economies experiencing similar economic change.

Our paper assesses whether meritocracy has increased between two cohorts that have been exposed to very different policy environments. The richness of our data, and the fact that it is panel data from two cohorts, enables us to look at the complex and dynamic inter-relationship between social class, ability, education and labour market outcomes. We make a unique contribution to the literature in a number of ways. Firstly, we are able to give a fuller picture of meritocracy in UK society, by assessing changes in the meritocratic nature of the British education system, as well as changes in the labour market. Secondly, our data is superior in a number of other respects. We have relatively early measures of ability and cognitive skill and are therefore able to examine how such measures change throughout childhood. This contrasts with much of the literature that has relied on US data from the NLSY[5], which only contains cognitive skill measures obtained from tests taken in high school or even later. We also make use of early measures of non-cognitive skill, which have been shown to be important (Heckman and Rubinstein (2001), Bowles *et al* (2001a, 2001b)). Lastly we address some, though not all, of the methodological problems identified by Heckman and Vytlacil (2001)). In particular, Heckman and Vytlacil (2001) show that many ability measures, particularly those derived from the NLSY, are so strongly correlated with educational attainment that large numbers of education/ability cells are in fact empty. Our measures of cognitive ability come very early in childhood and can be considered more as determinants of final educational attainment rather than jointly determined outcomes.[6]

The paper is set out as follows. The next section describes our data, its advantages and the cognitive ability measures we construct. Then, in section three, we ask the question: to what extent does cognitive ability determine an individual's education level? We know that education is an important determinant of labour market success but does the education system provide a means of increasing social mobility or is it in fact a barrier to mobility? To pre-empt our results, we find that the effect of cognitive ability on educational attainment has actually decreased, while the role of parental social class and income in determining educational attainment has increased. In other words the education system has become less meritocratic. In section four, we ask whether the value of cognitive ability in the labour market has changed in recent decades, focusing on the impact of ability on unemployment, participation and wages. Having shown that, under certain assumptions, cognitive ability is becoming marginally more important in determining labour market success in terms of employment outcomes and earnings, we ask whether this will lead to a more meritocratic society.[7] Thus in the final section we return to the question of the determinants of cognitive ability, and in particular the role of social class, family income, early education and other parental inputs. We also consider the issue of inter-generational transmission of ability and socio-economic status. We show that parental income and social class have become increasingly important determinants of final cognitive development. Furthermore, the correlation between parent and child ability is considerable. We find evidence that these inter-generational correlations are very much mediated through socio-economic factors. In summary, our research suggests that Britain has not become a more meritocratic society, despite policy interventions designed specifically to bring this about.

2 Data

Our data combines highly comparable longitudinal information from two British cohorts, namely, the National Child Development Study of 1958 (NCDS) and the British Cohort Study of 1970 (BCS). The former follows the cohort born in Britain in the week 3-9 of March 1958, with follow ups on the children and their families and school environments at the ages of 7, 11 and 16. Further follow up studies were undertaken in 1981 (age 23), 1991 (age 33) and 2000 (age 42). BCS is a longitudinal study of British children born between 5 and 11 April 1970, with follow ups at ages 5, 10, 16, 21, 26 and 30. Therefore the two studies are not identical, since respondents were not interviewed at exactly the same ages. Nonetheless, the questions asked of the two sets of respondents were very similar, enabling cohort comparisons to be made.

An advantage of our data is that we have full information on initial social class, early parental inputs, early cognitive ability, schooling, educational attainment and subsequent measures of socio-economic success. Many other papers in this field have had to rely on contemporaneous information on parental social class and respondents' educational attainment. This latter approach necessarily regards educational achievement as determined purely by individual efforts and potential 'ability', and not as a product itself of unmeritocratic influences.[8] In this paper we are able to look at the determinants of both educational attainment and indeed cognitive ability.[9]

We follow the recent literature in this field, combining individual cognitive ability test scores and investigating the effect of these test scores on subsequent socioeconomic outcomes.[10] Unlike most of the literature however, we have early measures of cognitive ability from tests preceding entry into secondary schooling. The problem with any type of ability test is that it will provide only an approximate measure of an individual's genuine potential ability. We argue however that measures obtained in earlier stages of an individual's childhood may prove less sensitive to environmental influences.[11]

The key ability measure in this paper follows partially the methodology used in Cawley *et al* (1996,1998a,1998b,2001). Test scores obtained at the age of 11 in the NCDS and at the age of 10 for BCS[12] constitute the basis for the analysis because of the proximity in terms of age across cohorts, the similar type of scores derived[13] and the fact that this age provides a reasonable compromise between the objective of obtaining reliable and stable measures of cognitive ability and that of removing as many educational inputs as possible. As has been said, in contrast to the ability measures in the NLSY used by Cawley and others, our ability measures precede individuals' eventual educational achievement level. The other advantage of using the age 10/11 test scores is that the tests were administered at an almost identical age for both cohorts, and thus the potential for parental and other environmental influences to affect measured scores is similar.[14] Test age is a particularly important issue and a draw back of the NLSY data used most often in this field is that older cohorts were tested at a later age. Because some smart younger children will be subject to worse environmental influences, measurements of their cognitive attainment at a later age would provide lower figures than suggested by early measurement. Thereby, conditioning on this score would often lead to misleading comparisons, even after residualizing scores on youth's age.

Our data is not exempt from problems either. Because the tests administered for the two cohorts were not exactly identical, it is not possible to use a raw test score in the analysis. Using dummies for quintiles of the distribution of scores has been the standard approach so far, but the relatively high correlation between the different test scores often leads to multi-collinearity problems and other missing data issues when trying to interact them with other variables of interest.[15] We attempt to circumvent these problems by calculating the first principal component for each cohort from the set of available tests. Statistically, the first principal component is a linear combination of the original test scores with the property of maximising the total explained variance. In the psychometric literature, this measure has been frequently associated with the construct "g", described as the underlying general ability or intelligence factor. In a series of papers using the NLSY data, Cawley *et al* (1996,1998a,1998b,2001) find that the coefficient on "g" in the log wage regression is positive and statistically significant in all cases, although it is rarely the case this is the only significant component from the possible ten orthogonal components that can be derived from the Armed Services Vocational Aptitude Battery (ASVAB).

The arguments about the best way to measure general intelligence continue. We take a pragmatic view. The main reason for using a construct of "g" is to enable the conversion of a set of ability variables into a single, continuous, cross-cohort comparable variable. Our interpretation of this variable is that of an index that allows us to rank each individual, within her own cohort, in terms of cognitive ability.[16]

Information about the process of extracting g in each cohort from the set of available ability scores is provided in table 1. The first two columns indicate the principal component order and the cumulative proportion of the overall score variation explained by principal components. Columns 3 and 4 specify the correlation between each test score and the first principal component, which can be considered as an indicator of the contribution of each score to the construct g.

Table 1: Cognitive ability indexes at age 11/10

Pcpal comp. (1)	Cumul.var.expl. (2)	Original test scores (3)	Corr:(Score, g) (4)
NCDS (1958 cohort)-Age 11			
g(5)=**1**	**0.69**	Copying designs	0.26
2	0.85	Verbal ability	0.50
3	0.92	Non verbal ability	0.48
4	0.96	Maths	0.49
5	1.00	Reading	0.46
g(4): Four scores only. Correlation (g(5),g(4))=0.9951			
g(4)= **1**	**0.81**	Verbal ability	0.51
2	0.90	Non verbal ability	0.49
3	0.96	Maths	0.50
4	1.00	Reading	0.48
g(3): Three scores only. Correlation (g(5),g(3))=0.9862			
g(3)= **1**	**0.84**	Ver+non ver.ab.	0.58
2	0.93	Maths	0.58
3	1.00	Reading	0.56
BCS (1970 cohort) -Age 10			
1	**0.82**	Friendly Maths Test	0.57
2	0.91	Edinburgh Reading Test	0.58
3	1.00	British Ability Scales	0.58

NOTE: Col.(1) indicates the order of extraction of principal components (p.c.) under different specifications, with values in col.(2) representing the cumulative proportion of variance of scores explained by principal components. Col.(3) labels in each section denote the scores used to derive each set of p.c., accompanied in col. (4) by correlation of each test score with the first p.c. in each case. NCDS-age 11 p.c. derived under three alternative sets of test scores: i)All five. ii)As i), excluding copying designs. iii)As ii), aggregating verbal and non verbal a single score through addition.

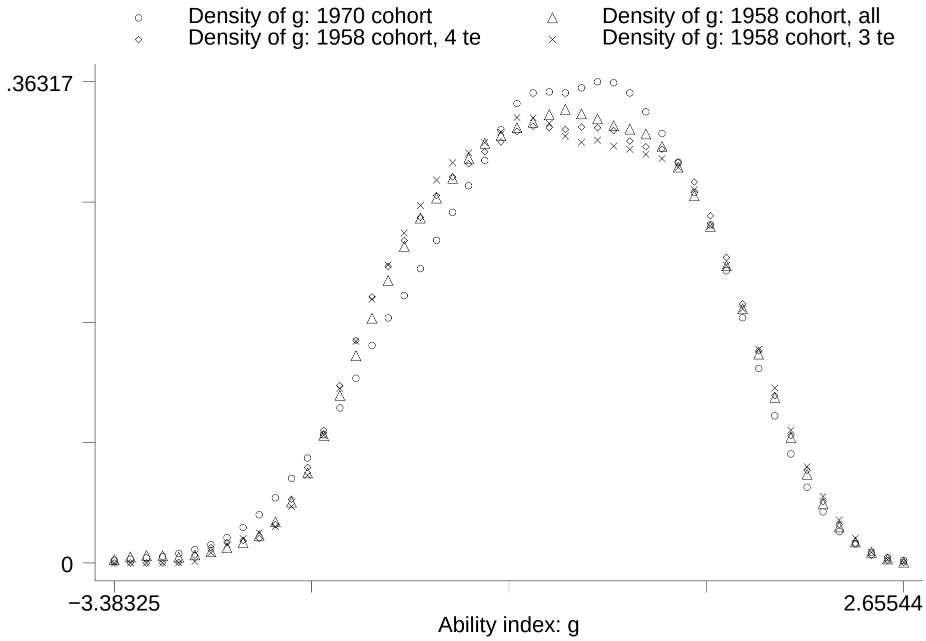
Because there are more tests available in NCDS (5) than in BCS (3), we observe that the first principal component in the former case explains a lower proportion of the total variation. Substantial differences in the variation of g across cohorts can also be due to test differences such as the absence of a copying designs test in BCS.[17] In order to explore these possibilities, we have calculated g for the NCDS cohort in three different possible ways: including all scores, excluding copying designs and aggregating verbal and non-verbal ability into one score. Table 1 also displays the correlations between alternative specifications, which suggest a considerable degree of robustness (98/99 % correlation).

Additional robustness checks are needed to support the comparative cohort analysis using the g index. Comparing NCDS results (with three scores) and BCS, one can see that the proportion of variance explained by the first component is highly similar (84% vs 82%, respectively) and the correlations with general ability, maths and reading are also very similar across cohorts.[18] Finally, we also compare the distributions of the ability indices, as displayed in figure 1. This confirms the high correlation between different constructs of g for NCDS. It also reveals a very close similarity between the distribution of g for NCDS and BCS. All this evidence leads us to accept measured g as a comparable index of individual's ranking, in terms of cognitive ability, within their own cohort.

In addition to this cognitive ability index, an indicator of behavioural adjustment at age 10/11 is used as a proxy for certain non-cognitive abilities. This indicator is derived from the Bristol Social Adjustment Guide (BSAG), which measures the child's capacity to adjust to different social environments and circumstances, as well as providing an indication of his or her hostility or depression. This antisocial index is constructed by adding up the number of items and then standardising the total score. Higher values represent lower adaptability. The importance of this type of measure of non-cognitive skill has been emphasized by Heckman and Rubinstein (2001), Cawley *et al* (2001), Osborne (2000) and Bowles *et al* (2001a).

Additional controls used in this paper include: Father's social class at birth and at age 11/10, measures of family income at age 16, parental education and age when child was

Figure 1: Ability indexes at age 11/10



NOTE: Kernel density estimates of cognitive ability index distribution for BCS and NCDS (under three alternative specifications specified in table 1).

born and number of children in household at age 11/10. We noted earlier that parental social class may influence the child's outcomes in a manner that is not necessarily unmeritocratic. In particular, higher SES families may invest more in their children in terms of parental time, interest and taste for education. We therefore control for this as best we can by including indicators of what teachers think about both father's and mother's interest in their child's education at age 10/11, which have been shown to be important determinants of educational attainment (Feinstein and Symons (1999)).

3 Education opportunities and attainment

Most assessments of the changing meritocratic nature of our society focus on whether an individual's ability and effort play a more important role in determining their socio-economic success. Ability and effort are measured in numerous ways, with educational attainment often included as an indicator of both ability and effort. The assumption is that education is an essentially meritocratic determinant of socio-economic outcomes. However, if in fact social class differences are cemented or magnified by the education system, this assumption is fundamentally flawed. Thus to give a fuller picture of meritocracy in Britain, we first investigate the relationship between ability, social class and educational attainment.

To examine whether the educational system has become more meritocratic, i.e. whether cognitive ability has a greater role in determining educational outcomes than was the case in the past, we estimate an ordered probit model where the dependent variable is the highest achieved academic qualification level. There are five educational attainment categories: (i) No qualifications, (ii) Certificates of Secondary Education (CSEs, grades 2 to 5) or less than 5 Ordinary levels (O levels)[19], (iii) More than 5 O-levels[20], (iv) Advanced levels (A levels)[21], (v) Degree or higher.[22] This statistical model assumes that there is an underlying index describing an individual's propensity to invest in education, which depends linearly on a series of factors, including measures of ability and other family and parental socio-economic characteristics. Full estimates are displayed in table 2. Summarized information about the marginal effects of key selected variables on the probability of reaching a given qualification level are provided in table 3.

For each cohort, and for both men and women, cognitive and non-cognitive ability are important determinants of educational attainment. The results also suggest that in the later cohort there has been a reduction in the marginal effect of cognitive ability on the probability of obtaining A-levels, although there has been no change regarding the effect of cognitive ability on the probability of becoming a college graduate. Simultaneously, for the later cohort there has been an increase (particularly for men) in the marginal effect of parental income (measured at 16) on the probability of obtaining a higher education qualification. Broadly speaking, we are looking at a process of investment in education that takes place between age 10 and 22. For the NCDS cohort this covers the period from

Table 2: Determinants of educational attainment: Ordered probit estimates

	Men				Women			
Variable	NCDS		BCS		NCDS		BCS	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Cognitive ability index	0.731	0.033	0.582	0.040	0.765	0.035	0.609	0.041
Antisocial index	-0.085	0.025	-0.037	0.032	-0.084	0.032	-0.071	0.038
Log family income at 16	0.029	0.047	0.178	0.061	0.166	0.050	0.203	0.061
Father's SES at 11/10								
Professional	0.398	0.156	0.335	0.234	0.362	0.178	0.618	0.225
Intermediate	0.281	0.135	0.297	0.194	0.255	0.136	0.509	0.166
Skilled non-man	0.195	0.136	0.422	0.204	0.164	0.139	0.411	0.171
Skilled manual	0.149	0.116	0.089	0.180	0.207	0.122	0.258	0.146
Semi-skilled	0.103	0.123	0.217	0.194	0.048	0.126	0.235	0.158
Father's SES at birth								
Professional	0.508	0.161	0.591	0.241	0.228	0.166	0.384	0.216
Intermediate	0.226	0.117	0.268	0.181	0.035	0.119	0.264	0.155
Skilled non-man	0.115	0.117	0.155	0.171	0.069	0.116	0.079	0.148
Skilled manual	0.061	0.090	0.140	0.150	0.051	0.090	0.215	0.124
Semi-skilled	-0.019	0.104	0.063	0.163	-0.045	0.102	0.299	0.138
Parental education								
Father middle	0.212	0.072	-0.006	0.106	0.056	0.072	-0.086	0.098
Father high	0.290	0.100	0.211	0.135	0.180	0.104	-0.041	0.126
Mother middle	0.141	0.065	0.207	0.096	0.201	0.063	0.323	0.092
Mother high	0.101	0.112	0.239	0.151	0.592	0.122	0.578	0.144
Father's age at birth	-0.006	0.006	0.002	0.008	0.000	0.006	0.000	0.008
Mother's age at birth	0.010	0.007	0.000	0.009	0.003	0.007	0.003	0.009
Father's interest in ed.								
Middle	0.277	0.087	0.048	0.174	0.201	0.095	-0.227	0.209
High	0.393	0.100	0.172	0.184	0.308	0.111	-0.048	0.209
Teacher can't say	0.312	0.090	0.123	0.172	0.255	0.099	-0.130	0.200
Mother's interest in ed.								
Middle	0.046	0.094	0.065	0.188	0.028	0.104	0.431	0.195
High	0.060	0.103	0.167	0.197	0.140	0.118	0.555	0.199
Teacher can't say	-0.151	0.116	0.157	0.206	-0.062	0.127	0.380	0.202
Cutpoints (ancillary parameters)								
No quals to CSE,O-lev(-)	-0.359	0.254	0.477	0.405	0.044	0.272	0.612	0.388
CSE,O-lev(-) to O-lev(+)	0.377	0.255	0.902	0.406	0.711	0.272	1.156	0.387
O-lev(+) to A-level	1.708	0.259	2.169	0.408	2.158	0.276	2.596	0.389
A-level to Higher Ed.	2.065	0.261	2.403	0.409	2.632	0.279	2.912	0.390
Observations	2561		1467		2601		1620	
Pseudo R2	0.1906		0.1519		0.1852		0.1572	
Log-likelihood	-3136.79		-1769.37		-3174.91		-1910.09	

NOTE: Full set of coefficients from ordered probit estimates of highest educational attainment. Robust standard errors displayed within parentheses. Selected marginal effects displayed below.

1968 to 1980 whereas the equivalent period in the BCS cohort is 1980 to 1992. These results do not suggest that the UK education system has become *more* meritocratic from

Table 3: Marginal effects of cognitive ability and log-income

		Men		Women	
Education group	Variable	NCDS	BCS	NCDS	BCS
CSEs/O-levels(-)	Ability	-0.053	-0.033	-0.058	-0.046
	Log-income	-0.002	-0.010	-0.012	-0.015
O-levels(+)	Ability	0.009	-0.029	-0.002	-0.053
	Log-income	0.000	-0.009	-0.001	-0.017
A-levels	Ability	0.025	0.011	0.039	0.014
	Log-income	0.001	0.003	0.008	0.004
Higher education	Ability	0.153	0.159	0.164	0.166
	Log-income	0.006	0.049	0.033	0.055

NOTE: Based on ordered probit estimates of the probability of achieving a given level of educational attainment, derived from table 2. No qualifications category excluded from table (marginal effects add up to nil).

the seventies to the eighties.[23]

Although our evidence suggests family income is an important determinant of educational attainment, this might be simply because parents who are more interested in their child's education, and whose children consequently do better at school, also happen to be wealthier. We therefore follow Feinstein and Symons (1999) and control for the level of parental interest in the child's education. These variables are important. Furthermore, these parental interest variables are not responsible for the observed changes between the cohorts in the effects of income or other family characteristics on educational attainment.[24] The significance of family income as an important determinant of educational attainment is also supported by new quasi-experimental evidence, also from the UK, on a recently piloted government initiative that pays children or families an allowance if they stay on in school after the compulsory school leaving age.[25]

We have also investigated the existence of cognitive ability and family income interactions in the determination of an individual's propensity to obtain more education. Table 4 provides evidence on this. For the 1958 cohort, the effect of ability was almost independent of income. For the 1970 cohort the positive effect of ability on attainment is only noticeable for those with higher family incomes. Moreover, the independent effect of income also appears to be higher than for the older cohort. Thus for the later cohort, cognitive ability only leads to higher chances of success in education for higher levels of family income.

Table 4: Ability-income interactions in educational attainment: Ordered probit coefficients

	Men		Women	
	NCDS	BCS	NCDS	BCS
Cognitive ability index 11/10	0.55	-0.53	0.60	-0.09
	(0.17)	(0.26)	(0.20)	(0.25)
Log parental income at 16	0.12	0.27	0.24	0.34
	(0.04)	(0.05)	(0.05)	(0.04)
Ability index*log income	0.06	0.22	0.04	0.14
	(0.04)	(0.05)	(0.05)	(0.04)

NOTE: Based on ordered probit estimates of the probability of achieving a given level of educational attainment. Other controls include measures of parental and maternal interest in child's education from teacher's reports and number of children in household at 11/10.

Further investigation of family income, social class and cognitive ability interactions confirmed that the expansion of the British education system appears to have disproportionately benefited children from wealthier backgrounds and higher social classes.[26] For example, we found that for girls in the highest ability quartile, the probability of getting a degree if they come from a family in the bottom income quintile goes down from 38% to 29% between the cohorts. For a girl whose family is in the top income quintile, this probability increased from 60% to 77%. For boys, the participation gap by income group becomes larger between the two cohorts, and these results also hold true if we separate children from different social classes. For example, consider again the top ability quartile: sons of professionals increased their probability of getting a degree from 76% to 85% whereas sons of unskilled workers had a reduced probability of becoming a college graduate, from 40% to 19%.

All this evidence paints a convincing picture of an increasingly unmeritocratic education system, despite being a period of rapid expansion in the UK education system. Thus, although the probability of a randomly selected child achieving a higher level of qualification increased over the period, this expansion has not improved the educational opportunities for all income groups and social classes equally. Nor has this expansion been largely about more able children gaining better educational opportunities. Instead, it is the children from the wealthiest backgrounds that have benefited most.

4 Labor market outcomes

In this section we assess the extent of meritocracy, as we have defined and measured it, in the UK labour market. Clearly labour market success is not the only outcome of potential interest. There are many other ways in which a society might reward cognitive ability that, although not related to labor market success, may have an economic value in themselves.[27] Our focus though is on standard measures of economic success which are undoubtedly related to an individual's economic well being. Specifically we provide evidence on the effects of cognitive ability on labour market participation and hourly earnings.[28] Since we have already shown that cognitive ability partly determines educational attainment, we also explore the inter-relationship between cognitive ability, education and eventual labour market success.

4.1 Participation effects of ability

In this section we assess whether cognitive ability is a strong predictor of an individual's economic activity status and whether significant changes have occurred between the two cohorts. In a more meritocratic society, cognitive ability should be a more important determinant of whether an individual is unemployed, as opposed to other characteristics, social background or just luck. To compare patterns across cohorts, we use the retrospective information contained in the NCDS33 and BCS30 to obtain information on the respondents' economic activity at an identical age. We chose to compare individuals shortly before their twenty-ninth birthday, in the month of January. The intention here is to minimise the problem of recall bias, as it is most recent available common date for members of both cohorts. We also aim to overcome the problem of differential seasonal effects by choosing the same month in the two years.[29]

Table 5 shows the male marginal effects from a probit estimation where the dependent variable takes a value of one if the person is unemployed, zero otherwise. We estimate the model with and without our cognitive and non-cognitive ability measures, namely g and the index of anti-social behaviour respectively. Specifications without these two variables suggest that academic and vocational qualifications play an important 'protective' role against unemployment. Mother's education and parental social class also appear to be important protective factors. When we include our two ability measures however, the predictive power of the qualifications variables falls substantially for both cohorts. Only intermediate vocational qualifications retain some part of their initial explanatory power. Thus, it is ability, both cognitive and non-cognitive, that is the more powerful determinant of whether a person is unemployed at a given time. Estimates suggest there are no significant cohort changes in the effect of cognitive ability on the probability of unemployment.

For females, non-participation, rather than just unemployment, is important in our samples. Female participation in the UK has increased substantially in recent decades. Table 6 shows the results from a probit model where the dependent variable takes the value of one if the woman is not employed, zero otherwise. As for the male unemployment estimates, educational qualifications are important protective factors, guarding against non-employment.[30] However, unlike for the male model, the estimates on the qualification variables are robust to the inclusion of our cognitive and non-cognitive ability variables. With and without these ability controls, the positive effect from qualifications has increased in the later cohort, i.e those born in 1970. Thus, higher female participation has not been

Table 5: Determinants of unemployment among men: Probit estimates

	NCDS-Men (29)				BCS-Men (29)			
	Basic		Extended		Basic		Extended	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Aca.NVQ1	-0.251	0.110	-0.149	0.113	-0.055	0.134	0.018	0.137
	[-0.015]		[-0.008]		[-0.003]		[0.001]	
Aca.NVQ2	-0.388	0.098	-0.128	0.109	-0.209	0.101	-0.045	0.111
	[-0.024]		[-0.008]		[-0.012]		[-0.002]	
Aca.NVQ3	-0.435	0.165	-0.047	0.180	-0.544	0.221	-0.270	0.236
	[-0.021]		[-0.003]		[-0.022]		[-0.012]	
Aca.NVQ4	-0.576	0.142	-0.162	0.158	-0.484	0.132	-0.201	0.150
	[-0.028]		[-0.009]		[-0.024]		[-0.010]	
Aca.NVQ5	-0.442	0.252	0.039	0.267	-0.478	0.265	-0.061	0.283
	[-0.020]		[0.002]		[-0.019]		[-0.003]	
Voc.NVQ1	-0.112	0.115	-0.086	0.119	-0.038	0.116	-0.028	0.118
	[-0.007]		[-0.005]		[-0.019]		[-0.001]	
Voc.NVQ2	-0.063	0.104	-0.032	0.106	-0.369	0.126	-0.408	0.126
	[-0.004]		[-0.002]		[-0.019]		[-0.018]	
Voc.NVQ3	-0.163	0.118	-0.078	0.121	-0.276	0.126	-0.228	0.128
	[-0.010]		[-0.004]		[-0.014]		[-0.011]	
Voc.NVQ4	-0.234	0.118	-0.172	0.122	-0.164	0.133	-0.129	0.136
	[-0.014]		[-0.010]		[-0.009]		[-0.007]	
Cogn.ability			-0.190	0.051			-0.240	0.053
			[-0.012]				[-0.013]	
Antisoc.index			0.154	0.034			0.084	0.039
			[0.009]				[0.005]	
Intercept	-1.054	0.098	-1.408	0.110	-1.134	0.125	-1.393	0.145
Proport.unemp	0.039		0.039		0.034		0.034	
Observations	4178		4178		3639		3639	
Log-likelihood	-644.3		-622.4		-508.5		-491.8	
Pseudo-R2	0.069		0.100		0.060		0.091	

NOTE: Dependent variable=1 if unemployed, 0 otherwise. Sample: Active men. Other controls: Father's social class and parental education. Marginal effects within square brackets. Educational dummies refer to highest level of both academic and vocational qualification attainment.

uniformly distributed across the whole educational attainment spectrum. The role of cognitive ability also appears to have become stronger and this change is statistically significant. No strong evidence for any change in the effect of our non-cognitive ability measure was found.

We have also analyzed the phenomenon of increased female participation by looking into the determinants of the type of participation in the workforce.[31] More educated women who do participate are less likely to occupy part-time jobs. Women with higher qualifications also tend to be more likely to work full-time, and this phenomenon is also quite robust to controlling for measures of ability. Indeed, ability appears to have become a more important positive determinant of full time participation for women.

Table 6: Determinants of economic inactivity among women: Probit estimates

	NCDS-Women (29)				BCS-Women (29)			
	Basic		Extended		Basic		Extended	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Aca.NVQ1	-0.193	0.071	-0.142	0.072	-0.331	0.086	-0.298	0.086
	[-0.069]		[-0.051]		[-0.089]		[-0.081]	
Aca.NVQ2	-0.387	0.061	-0.278	0.067	-0.382	0.065	-0.275	0.068
	[-0.141]		[-0.102]		[-0.113]		[-0.082]	
Aca.NVQ3	-0.412	0.085	-0.254	0.094	-0.661	0.100	-0.482	0.105
	[-0.141]		[-0.090]		[-0.157]		[-0.122]	
Aca.NVQ4	-0.683	0.077	-0.512	0.088	-0.679	0.080	-0.506	0.086
	[-0.225]		[-0.175]		[-0.179]		[-0.138]	
Aca.NVQ5	-0.802	0.163	-0.618	0.171	-0.956	0.169	-0.707	0.175
	[-0.237]		[-0.195]		[-0.191]		[-0.159]	
Voc.NVQ1	-0.110	0.058	-0.097	0.058	-0.289	0.062	-0.272	0.063
	[-0.040]		[-0.035]		[-0.082]		[-0.077]	
Voc.NVQ2	-0.083	0.063	-0.076	0.064	-0.164	0.062	-0.168	0.063
	[-0.030]		[-0.027]		[-0.046]		[-0.047]	
Voc.NVQ3	-0.035	0.071	-0.015	0.071	-0.462	0.080	-0.460	0.080
	[-0.012]		[-0.005]		[-0.119]		[-0.118]	
Voc.NVQ4	-0.258	0.063	-0.251	0.063	-0.391	0.076	-0.374	0.077
	[-0.092]		[-0.089]		[-0.104]		[-0.100]	
Voc.NVQ5	0.556	0.172	0.570	0.173	-0.407	0.171	-0.340	0.172
	[0.217]		[0.223]		[-0.103]		[-0.088]	
Cogn.ability			-0.088	0.029			-0.158	0.028
			[-0.032]				[-0.047]	
Antisoc.index			0.051	0.025			0.042	0.025
			[0.018]				[0.012]	
Intercept	0.108	0.063	-0.001	0.069	0.166	0.076	0.019	0.080
Inactivity rate	0.359		0.359		0.245		0.245	
Observations	4335		4335		4139		4139	
Log-likelihood	-2724.9		-2716.5		-2151.0		-2132.4	
Pseudo-R2	0.038		0.041		0.068		0.076	

NOTE: Probit estimates. Baseline category: No qualifications, unskilled manual father and parents without any qualification. Estimated coefficients and robust standard errors reported. Marginal effects within square brackets. Other controls included are father's SES at birth and parental education measures.

4.2 Ability and earnings

This section investigates the following specific questions:

- Are measured wage returns to cognitive ability, i.e. g, identically distributed across different groups of workers?
- Are there any other abilities, aside from cognitive skills, that influence wages?
- Can this cohort data be used to identify changes in the returns to g over time, separately from age effects?
- Is it really possible to separately identify the effect of education and cognitive ability?
- How does g contribute to the explanation of unobserved wage differences?

First, we looked at the effects of cognitive ability on earnings by gender. Cognitive skills appear to be priced differently for men and women, with women's skills the more valuable. The gender gap in returns to g is around 4% (0.039) in the NCDS33 and falls to just under 3% (0.027) in the BCS (age 30).[32] This change parallels an observed reduction in level earnings differences between men and women: from a 0.37 wage penalty for women in the 1958 cohort to a smaller yet still significant value of 0.18 for the 1970 cohort. Qualitatively, these gender differences in the estimated 'returns' to g coincide with the result in Cawley *et al* (1996) and may reflect different patterns of labour market participation based on cognitive ability. Indeed, a one standard deviation increase in the cognitive ability index implies an increase in the probability of participation by 5.3 percent for men compared to 6.5 for women in the NCDS33, and an impact of 3.7 for men and 8.9 for women in the BCS30. This implies that female participation is more related to cognitive ability and might explain the subsequent observed gender differences in wage returns.[33] Comparing the two cohorts, the increased participation for women in the later cohort tends to reduce the gender gap in both levels and returns to cognitive ability, although the latter effect is not statistically significant. However, comparisons across the two cohorts for women are extremely problematic with changes in fertility patterns: the later cohort having fewer children at an older age. Therefore as we don't have reliable cross-cohort comparable exclusion restrictions to control for participation, we restrict the rest of our analysis on wages to men.

The male wage results are shown in table 7, which presents estimates of the effect of cognitive and non-cognitive ability on log hourly wages in each of the available surveys. Two specifications are provided: the first includes parental background information such as social class and education level. The second specification also includes the qualification level of the individual to control for highest educational attainment.

Table 7: Returns to ability: OLS estimates

	Without qualifications				With qualifications			
	Cognitive ability		Non-cog.ability		Cognitive ability		Non-cog.ability	
Survey	Coeff.	R.S.E.	Coeff.	R.S.E.	Coeff.	R.S.E.	Coeff.	R.S.E.
NCDS23	0.055	(0.010)	-0.023	(0.007)	0.049	(0.011)	-0.021	(0.007)
NCDS33	0.140	(0.009)	-0.039	(0.008)	0.077	(0.010)	-0.031	(0.008)
NCDS42	0.172	(0.010)	-0.039	(0.009)	0.098	(0.012)	-0.029	(0.009)
BCS21	0.065	(0.027)	-0.033	(0.021)	0.044	(0.026)	-0.030	(0.021)
BCS26	0.091	(0.011)	-0.017	(0.010)	0.065	(0.013)	-0.012	(0.010)
BCS30	0.130	(0.009)	-0.016	(0.008)	0.085	(0.010)	-0.009	(0.008)

NOTE: Dependent variable: Log-hourly wages. All regressions include parental education and social class. Specifications with qualifications include both academic and vocational highest qualification dummies. Robust standard errors within parentheses.

Even though inclusion of the highest qualification variables reduces the size of the estimated returns to both types of ability, for both cohorts, both of our cognitive and non-cognitive ability measures have a significant impact on an individual's economic success as measured by hourly wages. In this case, early assessments of children's capacity to interact with other individuals (our non-cognitive ability measure) help to explain not only their capacity to obtain higher qualifications, but also how the market will price their labour. This highlights the social dimension of the general concept of skill. Economists often wrongly see skill as a one-dimensional attribute, either measured by education level or cognitive ability test scores. However, this evidence confirms for the UK that different aspects of skill are valued in the labour market, consistent with some US evidence (Bowles *et al* (2001)).

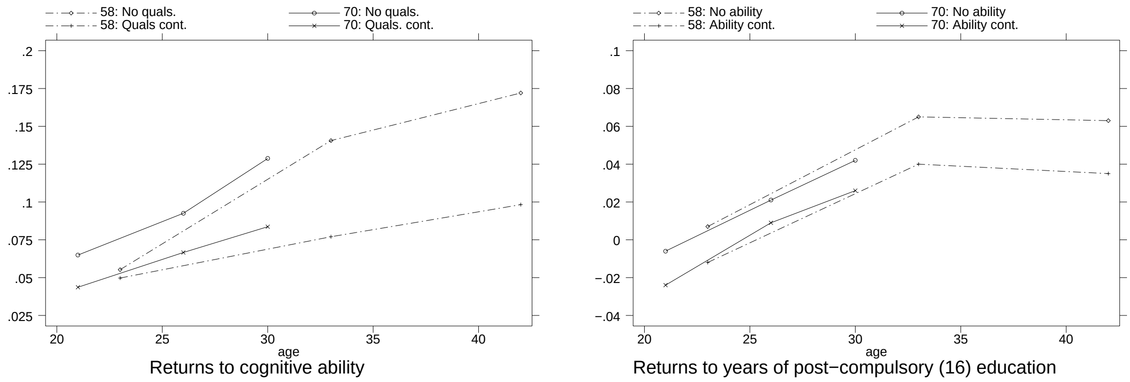
It is important to note that the cohorts have been compared based on estimates from different years and the age difference between the cohorts is quite marked for any NCDS/BCS pair of estimates (e.g. 3 years if we compare NCDS33 with BCS30). If, for example, cognitive ability is partially unobservable by employers but they learn about it over time, three years might involve a substantial difference in estimated returns. Alternatively, if more educated and more able individuals learn faster while employed and receive more training from their employers, one may expect a similar difference. With these caveats in mind, we now show what these estimates imply for life-cycle and cohort changes in the returns to ability.

A problem with cross-cohort comparisons, referred to in Heckman and Vytlacil (2001), follows from the difficulty in separately identifying age and year effects, given the lack of data for many of the possible age-year combinations. In our case, this problem is stronger because there are only three different year observations for each cohort, and there are only two cohorts.

We carry out a graphical interpolation exercise can be considered as a less restrictive imposition on the data than an arbitrary functional form. Figure 2 displays the point estimates of returns to g reported in table 7 on its left. The figure on the right hand side documents the estimated returns to years of full time education after the age of compulsory schooling.[34]

The severity of our missing data problem cannot be denied. There is no common age support for age values higher than 30 and younger than 23. Having only two cohorts, time effects are restricted to twelve-year long intervals (the difference in birth dates for both cohorts) that must refer to relatively young workers (ages 23 to 30). However, there are important features that emerge from such limited data, such as a clear life-cycle pattern of increasing returns to ability (over the set of observed age values) which is common to both cohorts.

Figure 2: Returns to cognitive ability and years of education over lifetime: By cohort



NOTE: Returns to measure of cognitive ability displayed by cohort and two specifications: (1) Including parental social class and education controls. (2) As in (1), including detailed individual qualifications. Returns to years of post compulsory (after 16) full time education displayed by cohort and two specifications. (1) With parental controls. (2) As in (1), including measures of cognitive and non-cognitive ability. All returns are based on OLS regressions of log hourly wages for working males in each survey.

The left part of figure 2 shows that the fitted ability returns/age profile for the later 1970 cohort always exceeds that for the 1958 NCDS cohort. We discuss the two specifications separately. Firstly, without qualification controls, the gap is marginally wider when the cohorts are in their early twenties, which corresponds to a comparison of the early 1980s with the early 1990s. According to the literature, this is the period when returns to education grew faster (Gosling *et al* (2000)). Thus, in order to make inferences about changes in this period we must rely on two relatively young cohorts, when returns to both education and ability are at their lowest. The gap in ability returns between the cohorts actually becomes smaller as age grows and the time comparison must refer to the late nineties versus the late eighties. This coincides with the deceleration in the upward trend in returns to education which was reported during the nineties.

After controlling for education, the gap in ability returns between the cohorts increases monotonically and the returns can be well fitted with a straight line. Cognitive ability is increasingly rewarded in the labour market as an individual grows older, and this pattern has become marginally stronger in the 1970 cohort.

For reference, we also display estimated returns to schooling by cohort under alternative specifications. With and without ability measures, returns to schooling appear to increase at least until the mid-thirties. For very young individuals, returns to education are not significantly different from zero because more educated individuals have only just joined the labour market and are compared to more experienced workers. Neglecting ability data leads to higher estimates of the returns to education. No significant differences can be found between cohorts for either specification (with and without ability controls).

As said, estimated changes in returns are specific for a particular age group, and we cannot say anything about other age values and time periods of interest. Figure 2 suggests that it would be misleading to infer a decrease in the returns to education from a crude comparison between NCDS at 33 and BCS at 30. However, since we observed non-decreasing wage ability and education profiles over the observed lifetime, we can interpret observed changes in the returns to ability and education between the two cohorts for such ages as lower bound estimates for the actual changes.

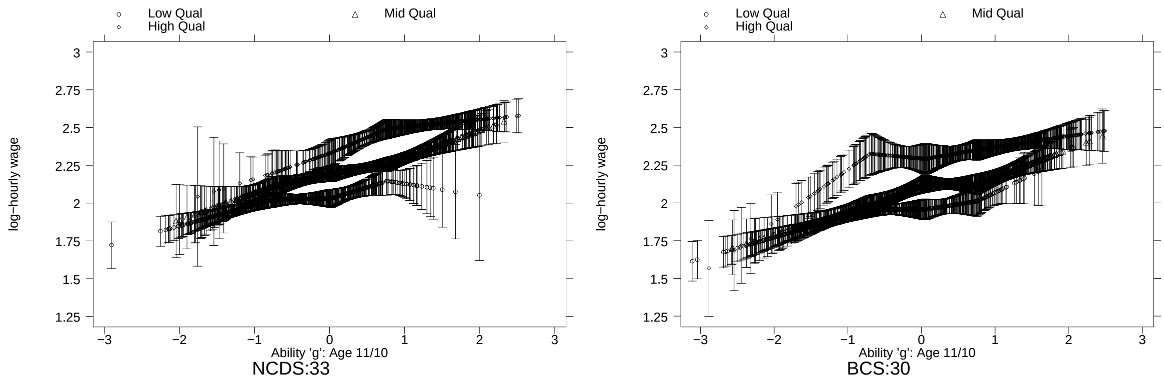
Another important problem we face when making inferences about the role of ability is the separate identification of ability and schooling effects (Cawley *et al* (1998a) and Heckman and Vytlacil (2001)). Earlier results about the determinants of highest qualification attained (e.g. table 2) indicate the presence of a strong sorting problem between ability and highest qualification attained. This implies a serious problem in identifying what the effect of higher education might be for an individual at the bottom of the ability distribution. Our data has the logical advantage of providing an ability index that precedes most educational investments and certainly final educational outcomes in terms of qualifications. The sorting problem in our data is therefore less pronounced but not completely absent, as we will now show.[35]

For each age-cohort group available, we have divided the sample into three grossly defined educational groups; 'low' (equivalent to high school dropout), 'middle' (equivalent to high school graduate) and 'high' (higher education degree). This is intended to increase cell sizes. For each one of these groups, we have estimated log hourly wage regressions on the ability index g using a flexible functional form specification based on splines, with knots at the 25^{th}, 50^{th} and 75^{th} percentiles in the ability distribution. This assumes that the effect of g on expected log wages, conditional on education, is linear within each ability quartile and continuous across the whole ability distribution.[36]

In order to ease the interpretation of results, we use graphs to display our estimates. We have plotted the predicted log hourly wages against our ability measure, g, with associated confidence intervals.[37] This type of graphical illustration is useful for two reasons: firstly, the sorting problem is easy to locate on the graph as sparsely populated areas indicate an insufficient number of observations to identify any relationship between ability, education and earnings.[38] Secondly, it is easy to identify the ability levels at which significant differences can be found between different education groups, namely where the confidence intervals for the predicted log wages do not overlap.

Figure 3 illustrates the returns to g and qualifications that can be found in the data for NCDS men at the age of thirty-three and BCS men at the age of 30. Certain patterns are common to both cohorts. The education/ability sorting problem described above is easily observed from the few observations corresponding to high qualifications in the bottom ability quartile. This explains the high standard errors. Furthermore, there are few observations with very high ability and low-level or no qualifications at all. The returns to ability (slope) appear to be positive whenever a sufficiently large number of observations can be found. However, the wage effect of qualifications does not seem to be so homogeneous. For example, no significant differences can be found between low and mid qualification for low ability levels. The estimated wage gains from obtaining a

Figure 3: Changes in returns to ability: By education



NOTE: Predicted wages for each education level and ability, with their confidence intervals. Based on a spline regression of log hourly real wages (pr=Jan 2001) on g, which is calculated from ability scores at the age of 11(10), by highest level of academic qualification. Sample: Working males with valid wage, ability and qualifications data. Notice the rising gap between high and mid educated individuals in BCS for low-intermediate ability levels.

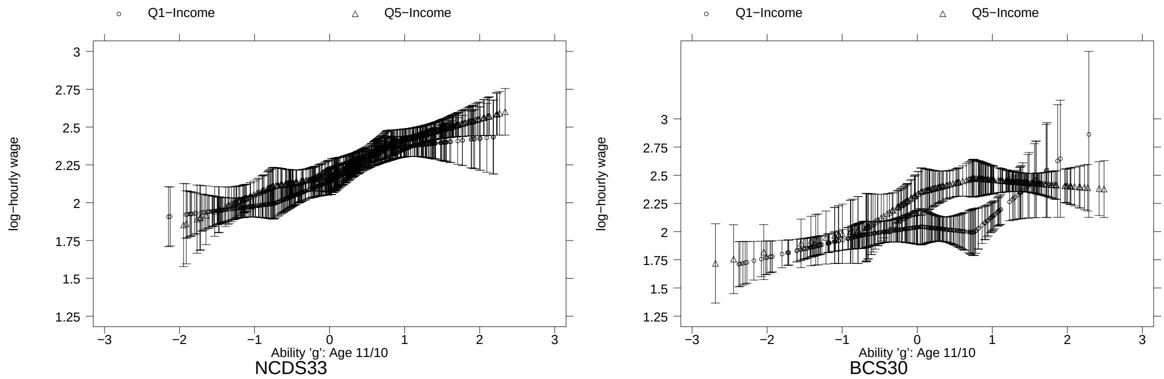
mid-level qualification are restricted to the remaining three quartiles.

We only find a statistically significant impact of higher education above the median value of g, although the benefit of higher education reduces as we move to the very end of the top quartile. It is important to note that for an individual at the 75^{th} percentile (g slightly below 1) the importance of obtaining additional qualifications is most evident.

With the caveats mentioned about making cross-cohort inferences about changes over time, it is nonetheless interesting to compare the two charts in figure 3. The sorting problem in the BCS data is less severe. There are many individuals with high qualifications who are in the bottom ability quartile, although it is certainly true that they are located closer to the 25^{th} percentile. The effect of mid-level qualifications appears to be concentrated at the middle of the ability distribution, thus suggesting an overall reduction in returns to these qualifications. Probably the most notable finding relates to the stronger effect of high level qualifications relative to mid-level ones. Positive returns to these higher level qualifications can now be found even for relatively low levels of ability, as the gap widens between the high and middle education 'clouds' for predicted wages.

So far, important interactions have been found between cognitive ability and education. We have also provided evidence on the role of parental socio-economic characteristics in determining children's cognitive progression and educational attainment. One issue remains unexplored as yet however. How do parental social class and income influence an individual's return to their cognitive ability and education level? Do these *unmeritocratic* influences extend themselves beyond endowments in childhood and youth? Have any significant changes occurred between cohorts?

Figure 4: Changes in returns to ability: By income groups



NOTE: Predicted wages for extreme parental income quintiles and ability, with their confidence intervals. Based on spline regression of log hourly real wages (pr=Jan 2001) on g calculated from ability scores at the age of 11(10), for the two extreme parental income quintiles. Sample: Working males with valid wage, ability and qualifications data. Cohort members born to parents in top income quintile (at age 16) compared to those in bottom quintile. Notice the widening gap in BCS between income groups at intermediate/high ability levels.

Figure 4 examines the returns to ability using the same type of spline specification used earlier in this section. Instead of separating groups by educational level, it depicts only workers whose parents were in the top and bottom income quintiles when they were 16. This tries to capture the overall effect of the primary variables (family background and ability) on wages. For the earlier NCDS cohort, returns to ability are fairly similar for individuals from wealthy and poor backgrounds. In the later BCS cohort, the gap between the 'rich' and 'poor' profiles widens for intermediate/high ability levels. Returns to ability for low income individuals now experience a massive increase a high levels of ability, suggesting some sort of differential 'threshold' effect.

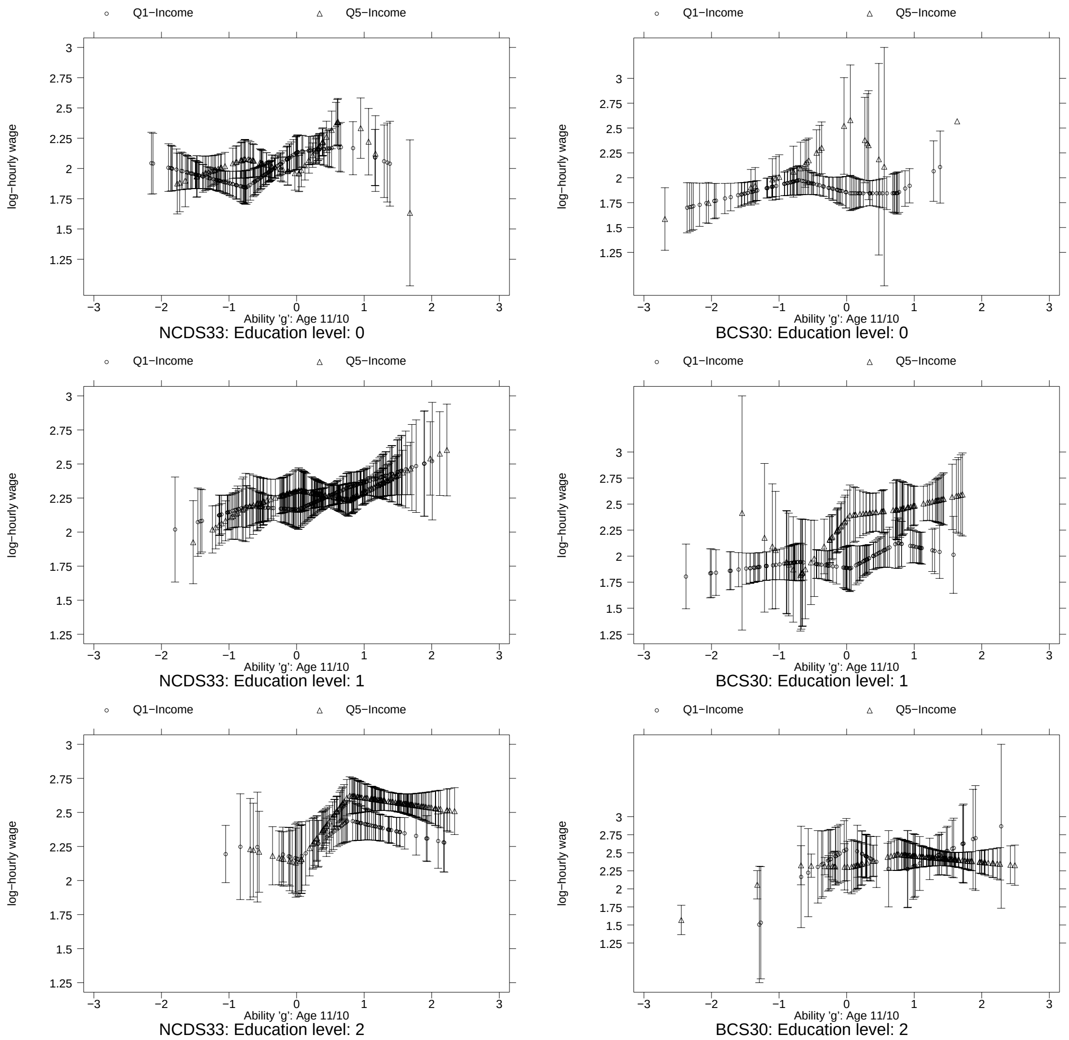
These findings about income gaps and returns to cognitive ability by parental income group are basically paralleled if one compares workers with fathers from high and low SES groups, using their occupational classification.[39] These differences may also be further investigated by estimating the log earnings-ability profiles for separate education and income groups, as in figure 5. For less educated men, there are no substantial differences in predicted wages between income groups in NCDS. In BCS, however, there are very few observations of men from higher income families with very low or no qualifications at all.

For men with an intermediate education level, class differences have become more acute almost everywhere in the ability distribution. Much of this widening gap is due to the educational composition of the widely defined 'intermediate' qualification group. Higher class individuals are more likely to have A-levels and this is reflected in higher predicted wages for similar ability levels.

Finally, class differences in predicted wages for graduate men that were found in the NCDS tend to disappear in BCS. However, few men from poor backgrounds have higher education qualifications. It thus seems that higher education is a successful social leveller, but access to it is not equally distributed in the population even after controlling for ability.

Between the two cohorts, differences between those from poor and rich backgrounds have shifted their main locus of influence down the ability distribution.[40] Individuals from lower income backgrounds who manage to get into higher education are now on a very equal basis with their peers from richer backgrounds. However, differences based on family income amongst those with intermediate level qualifications have become stronger. Further analysis shows this may be due to the heterogeneity of qualification levels within this group, which includes good O-levels and A-levels.[41] Individuals from richer backgrounds

Figure 5: Changes in returns to ability: By income and education



NOTE: NOTE: Predicted wages for extreme parental income quintiles, education levels and ability, with their confidence intervals. Based on spline regression of log hourly real wages (pr=Jan 2001) on g calculated from ability scores at the age of 11(10), by highest academic qualification attainment. Sample: Working males with valid wage, ability and qualifications data. Cohort members born to parents in top income quintile (at age 16) compared to those in bottom quintile, for each education level: (0: No/low quals, 1: Mid. quals, 2: High quals).

are more likely to acquire A-level qualifications, as opposed to vocational qualifications or just O levels. A levels also yield a higher return in the labour market. Generally, this evidence supports the view that social class effects are now principally mediated through educational attainment. Higher returns to ability at lower levels of ability for those from *richer* families, whereas returns to g at high ability levels are higher for the poorer. Again, this is consistent with the pattern of differentiated staying-on rates and access to higher education for rich and poor students.

5 The determinants of cognitive ability

5.1 Meritocratic and unmeritocratic influences

Our analysis so far has been based on an assumption that ability scores at age 10/11 are a reasonably good approximation to a child's potential ability. However, to make inferences about meritocracy based on these tests, we need to be sure that the ability measures themselves are not determined by unmeritocratic influences. However, as we already proved for educational attainment, measures of ability attainment are indeed sensitive to parental and other environmental influences, some of them possibly unmeritocratic. Parents invest in their offspring's development from as early as they become aware of conception, thus making measurements of genuine ability potential unfeasible.[42] Nonetheless, since our data provide earlier measurements of individual ability, we are able to analyse the determinants of ability progression in childhood and any changes across cohorts. This will enable us to make more definitive statements about any increase in meritocracy in the UK.

Mobility in the distribution of cognitive attainment throughout childhood has already been well documented in these data by Feinstein (1998, 2000). Using assessments of children's intellectual, emotional and personal development at the ages of 22 and 42 months and 5 and 10 years-old (provided in the BCS data), he examines the degree of correlation between 'ability' at these different stages. The 42 month ability rank appears to provide a fairly stable guide to a child's later position in the distribution, although there is a substantial degree of mobility. In fact the association of test rank with social class, for example, appears to strengthen with age, leading to increased polarisation by socio-economic status.[43] One possible explanation of course for this result is that parents from a higher social class influence their children's cognitive ability progression by spending more resources on them.[44]

Here we analyze the determinants of the measures of cognitive ability we used in the previous sections. We start with a simple linear specification of the ability index at 11 as a function of parental characteristics and early attainment indices.[45] Unfortunately, there is no age overlapping between early measures for NCDS7 and BCS5 which makes these measures less comparable. Table 8 provides the full estimation results of the expected index at 11 conditional on earlier ability and parental characteristics.[46]

Results suggest that measures of parental SES play an important role in determining the ability index at 11.[47] The coefficient on the earlier ability measure can be considered as the partial correlation between the earlier and later ability indices. This value is considerable and statistically significant, suggesting a considerable degree of serial correlation. However, it is important to note that this coefficient is smaller than one and thus allows for a substantial degree of mobility in the distribution of ability.

The simple fact that parental SES characteristics have an important effect on ability progression does not prove alone that the distribution of cognitive ability is the result of unmeritocratic influences. However, if earlier ability has become a less effective predictor of later ability and parental SES variables have become better predictors for the later cohort, this would imply that British society may have become less, rather than more, meritocratic over time.[48]

Assuming that the earlier ability index for BCS at 5 is a proxy for the unmeasured ability of BCS children at 7 (and thus comparable to NCDS), table 8 suggests that early ability has become a less important determinant of later ability by a large factor, for both boys and girls. Conversely, parental log income and SES appear to have become more correlated with ability at 11. Measurement error (driven by the unobservability of BCS ability at 7) may be responsible for these cohort differences. Greater measurement

Table 8: **Determinants of ability index at 11/10**

	Men				Women			
	NCDS		BCS		NCDS		BCS	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Cognitive ability index 5/7	0.577	0.016	0.349	0.028	0.576	0.014	0.435	0.023
Father's SES at 11/10								
Professional	0.088	0.083	0.525	0.138	0.081	0.088	0.340	0.141
Intermediate	0.122	0.061	0.306	0.128	0.224	0.066	0.181	0.116
Skilled non-man	0.121	0.064	0.352	0.134	0.202	0.069	0.079	0.119
Skilled manual	0.088	0.050	0.219	0.118	0.120	0.059	0.167	0.106
Semi-skilled	0.062	0.054	0.210	0.128	0.089	0.060	-0.016	0.112
Father's SES at birth								
Professional	0.100	0.093	0.355	0.136	0.266	0.080	0.112	0.126
Intermediate	0.036	0.060	0.121	0.128	0.132	0.058	0.248	0.103
Skilled non-man	0.060	0.058	0.161	0.122	0.098	0.057	0.180	0.099
Skilled manual	0.008	0.044	0.026	0.108	0.114	0.045	0.096	0.086
Semi-skilled	0.005	0.052	0.011	0.114	0.082	0.051	0.118	0.091
Parental education								
Father middle	0.095	0.043	0.133	0.062	0.119	0.037	0.111	0.059
Father high	0.172	0.057	-0.006	0.082	0.133	0.053	0.089	0.076
Mother middle	0.159	0.035	0.125	0.058	0.077	0.032	0.126	0.054
Mother high	0.123	0.059	0.239	0.088	0.235	0.053	0.102	0.076
Father's age at birth	-0.003	0.004	0.011	0.005	0.000	0.003	0.002	0.005
Mother's age at birth	0.006	0.004	-0.008	0.006	0.008	0.003	0.001	0.005
Father's interest in ed.								
Middle	0.189	0.047	0.132	0.130	0.097	0.046	0.327	0.113
High	0.351	0.054	0.301	0.140	0.275	0.054	0.331	0.117
Does not know	0.132	0.048	0.125	0.131	0.075	0.047	0.159	0.110
Mother's interest in ed.								
Middle	0.057	0.049	0.258	0.131	0.165	0.048	0.266	0.118
High	0.223	0.055	0.512	0.140	0.328	0.056	0.483	0.124
Does not know	0.064	0.059	0.221	0.143	0.075	0.061	0.211	0.128
Log parental income	0.079	0.024	0.115	0.038	0.059	0.023	0.085	0.035
Log number of children	-0.121	0.025	-0.052	0.052	-0.096	0.023	-0.025	0.047
Constant	-0.637	0.131	-1.485	0.263	-0.919	0.134	-1.371	0.239
Number of obs	3015		1734		2892		1771	
R-squared	0.5849		0.385		0.6128		0.4064	

NOTE: OLS estimations of expected ability score at 11/10, conditional on earlier attainment and additional family parental characteristics.

error of early ability in BCS could attenuate the estimated coefficient. However, it is possible to give an approximate value of the extent of measurement error that would be required to account for the observed cohort differences. Thus for BCS, the unobserved ability index that would be measured at age 7 following an identical procedure to that in NCDS can be written as $g_{5,i} = g_{7,i} + u_i$. The asymptotic bias for the estimated coefficient $\hat{\beta}$ in a regression of ability at 10 on ability at 5, where β satisfies $g_{10,i} = \beta g_{7,i} + \epsilon_i$, is determined by: $\beta\sigma_u^2/(\sigma_u^2 + \sigma_{g7}^2)$, whenever u and ϵ are independent and ϵ is independent of the unobserved $g_{7,i}$.[49] Under the assumption that the true β has not changed between cohorts, it is possible to infer the minimum proportion of the variance of $g_{5,i}$ which is due to error in order to fully explain the observed changes in estimated $\hat{\beta}$:

$$\frac{\sigma_u^2}{\sigma_u^2 + \sigma_{g7}^2} = \frac{\beta - \hat{\beta}_{BCS}}{\beta}.$$

Even though g at 7 for NCDS can also be measured with error, the key issue here is the existence of differential measurement error that could possibly explain the differences in the coefficients. Therefore one can fix $\beta = \hat{\beta}_{NCDS}$. These calculations reveal that no less than a figure between one third and one fourth of the total variation in measured g at 5 in BCS should be due to additional measurement error. The large differences in estimated coefficients thus suggest that measurement error does not seem to be the only reason for the observed decline in the relationship between earlier and later child ability.

We have also tried different models to explain progression throughout childhood in the ability distribution. We have estimated the conditional probability of being in a given ability quartile at 11, conditional on being in a given ability quartile earlier and being part of a family in a given SES group. Changes across cohorts in the gap between higher and lower SES groups can identify our parameter of interest if SES and cohort fixed effects remove the type of measurement errors discussed above. The conclusion is always that better off children find it easier in the more recent cohort both to keep their initial high position in the ability distribution and to move upwards when their initial position is low.[50]

5.2 Aspects of intergenerational transmission of ability

Of course no discussion about meritocracy or social mobility in Britain would be complete without an analysis of the extent to which parents transmit their cognitive ability (innate and acquired) to their children. To discuss properly the complex issue of intergenerational transmission of ability would require a separate paper. Furthermore, our data does not allow us to reproduce the cross-cohort comparative analysis carried out in previous sections in relation to intergenerational transmissions. Here we merely seek to provide a very approximate measurement of the statistical association between parental and child ability scores in the same way the intergenerational income mobility literature examines the correlation between parental and child income levels.

We follow Gregg and Machin (1997) in their examination of the Peabody Individual Achievement Test Scores (PIAT) on maths and reading available from the children of the NCDS cohort members.[51] In table 9, we provide a detailed analysis of the relationship between parental and child ability, and the robustness of this relationship to the inclusion of education and labour market characteristics of the parents.

We only consider information on the parent who is a cohort member, ignoring information on his/her partner.[52] In order to minimise the problem associated with the fact that the children of the NCDS cohort were tested at different ages, we include a cubic polynomial of the children's age.[53]

Our estimates suggest strong ability transmission effects from parents to their offspring, particularly by mothers. It is remarkable to find that cognitive ability measured at age 11 and age 7 has a significant impact on the ability of the respondent's own children. The fact that in most circumstances both parental age 7 and 11 scores are significant indicates that part of the cognitive progression which happens throughout the parent's childhood is also transmitted to the child. Parents' school qualifications also play an important role in determining reading scores, with some impact on maths scores too. It is also important to note that social class effects on children's attainment are not removed completely by including measures of parental education and ability. [54] Moreover, children of unemployed fathers appear to have lower maths and reading scores. We do not find any negative impact of maternal work on scores.[55]

Table 9: Determinants of offspring's ability scores

	Reading scores		Maths scores	
	Father	Mother	Father	Mother
Occupation				
Professional	0.144	6.027	-6.882	3.387
	(3.549)	(3.861)	(2.475)	(2.693)
Managerial/interm	0.567	2.818	-3.977	3.074
	(2.611)	(1.518)	(1.967)	(1.192)
Skilled non manual	-0.909	2.802	-4.671	3.402
	(2.682)	(1.436)	(2.010)	(1.160)
Skilled manual	-0.277	0.313	-5.036	2.191
	(2.512)	(1.810)	(1.900)	(1.803)
Semi-skilled	-0.809	1.573	-6.418	1.356
	(2.637)	(1.461)	(2.069)	(1.199)
Activity status				
Part-time work	8.211	1.653	6.063	1.099
	(3.577)	(0.922)	(2.214)	(0.689)
Looking after family	-0.529	0.140	0.612	-1.288
	(7.688)	(1.048)	(3.207)	(0.767)
Unemployment	-3.729	2.046	-1.526	2.761
	(1.843)	(2.562)	(1.246)	(2.274)
Other	-4.470	5.177	0.052	3.486
	(3.355)	(2.538)	(2.388)	(2.397)
School qualifications				
CSEs	3.245	-1.014	2.172	-0.080
	(1.430)	(1.287)	(1.138)	(1.018)
$<$ 5 O-levels	3.282	0.830	2.070	-0.329
	(1.670)	(1.296)	(1.152)	(0.879)
$\geq$ 5 O-levels	6.469	1.766	3.361	1.459
	(2.086)	(1.447)	(1.530)	(1.060)
A-levels	3.950	4.504	2.641	1.352
	(2.491)	(1.626)	(1.872)	(1.393)

Continues next page...

	Reading scores		Maths scores	
	Father	Mother	Father	Mother
Post-school qualifications				
Low vocational	2.476	1.600	1.643	0.383
	(1.348)	(0.841)	(0.927)	(0.659)
Mid vocational	1.466	-0.379	-0.494	-2.823
	(1.443)	(1.295)	(1.022)	(1.095)
High vocational	2.700	0.443	0.650	0.309
	(1.604)	(1.155)	(1.294)	(0.900)
Degree+	1.566	-3.351	-0.187	-0.058
	(2.796)	(2.056)	(2.195)	(1.924)
Ability variables				
Ability index at 7	1.239	1.503	1.017	0.081
	(0.789)	(0.581)	(0.525)	(0.456)
Ability index at 11	0.668	2.718	0.128	2.379
	(0.902)	(0.686)	(0.706)	(0.522)
Antisocial index	-0.118	-0.089	-1.056	-0.220
	(0.542)	(0.435)	(0.381)	(0.330)
Constant	-50.251	-69.193	-34.384	-65.335
	(16.482)	(9.977)	(12.051)	(7.276)
Observations	574	1033	579	1036
R-squared	0.68	0.74	0.77	0.78
Ability F-stat	2.61	21.69	4.88	15.28
Ability P-value	0.05	0.00	0.0024	0.00

NOTE: Ordinary least squares regression of PIAT maths and reading scores from cohort members' children tested in 1991. Regression includes a cubic polynomial in the child's age. Standard errors robust to clustering by parental identity are within parentheses.

6 Conclusions

Our extensive empirical investigation suggests, in broad terms, that Britain has not become more meritocratic in recent decades. Specifically we investigated whether ability has become a more important determinant of educational achievement and then whether it has a greater role in determining labour market success, principally earnings.

The key results can be summarised as follows:

1. The impact of cognitive ability on educational attainment has actually decreased, while the role of parental social class and income has increased. In other words, it

is not the most able who have benefited from the expansion of the UK education system but rather the most privileged.

2. As has been found in the US, cognitive skills are an important determinant of British labour market success, independent of any effect of educational attainment. Specifically, those with higher cognitive skills are less likely to be inactive and unemployed and, in the case of women, more likely to be in full-time, rather than part-time, work. Cognitive skills also have an impact on wages. The pricing of cognitive ability differs between men and women, with women's ability appearing to be the more valuable partly due to participation effects.

3. Returns to cognitive ability increase over the lifetime and appear to have slightly increased over the decade of the nineties. The literature suggests that the strong increase in returns to education throughout the eighties slowed down during this period. Our estimates referring to this period are based on very young individuals and we can only find a small increase in returns to ability. These conclusions come of course with caveats about the problems of making inferences about changes in returns over time with panel data derived from only two cohorts and limited longitudinal observations.

4. We also consider the impact of ability on wages for different social groups and educational levels. The results suggest that, at least in terms of higher education, the expansion of the education system in Britain has disproportionately benefited the higher social classes. Less able children from higher social classes are more likely to participate in higher education and they then go on to benefit from the on-going increase in the labour market demand for graduates. Nevertheless, higher education appears to have become a successful class leveller in that, conditional on achieving a degree, we do not find differences in the price of cognitive skills for different social classes.

5. We have shown that children's cognitive skills can change throughout childhood. However, children from higher social classes and wealthier families are more likely to move up the ability distribution, when their initial attainment is low. They are also more likely than poorer children to remain at the higher end of the ability distribution, when their initial attainment is high. Not only is social class important in determining a child's position in the ability distribution (and their movement up and down it) but there is also evidence that the cognitive gap between children from higher and lower social classes has widened between the two cohorts considered here.

It could be argued that this is entirely due to a higher association between better parental genes and parental social class, as if higher meritocracy had been achieved in the cohorts of NCDS and BCS members' parents. This argument cannot explain observed cohort changes in the patterns of children's ability progression. Additionally, as our NCDS estimates of intergenerational transmission of ability suggest, observed correlations between the ability of parents and their offspring, though considerable, cannot support the view that parental ability is the only determinant of children's scores.

These findings are broadly at odds with hypothesis that Britain has become an increasingly meritocratic society, unless we are willing to expand our notion of merit to include parental socioeconomic achievements. The fact that social class has become a more important determinant of educational achievement is particularly worrying. During this period there was considerable reform to the English education system, most of which was designed to make the system less class-ridden. For example, the 1958 cohort in our data would have experienced an extremely selective education system with the widespread use of 'grammar' schools.[56] The 20% of pupils who attended these schools were supposed to be the most able students but in fact social class was an important predictor of whether a student attended a grammar school and the educational opportunities for those who did not make it into grammars were extremely limited. Furthermore, less than one in ten students stayed on into higher education at that time. The 1970s cohort, by contrast, experienced mostly ‘comprehensive’ schools, attended by students of all abilities. Furthermore, the education system had expanded and around one in three students would have stayed on into higher education. Yet this expansion appears to have disproportionately benefited the higher social classes. Ability actually plays a less important role for the younger cohort. Many explanations are possible, not least of which is that by removing ‘elitist’ ability related selection mechanisms in the system, such as grammar schools and streaming students by ability, we have actually enabled parental social class to become a more important determinant of success.

On the other hand, it appears that the British labour market has become only marginally more meritocratic, in the sense that cognitive ability has become more important in determining earnings and other indicators of labour market success. Yet even this finding is undermined by our result that social class has become a more important determinant of cognitive skills. Certain economic developments and reforms, such as skill biased technical change and the reduction in union power, may have made individual ability a more important determinant of labour market success, but if cognitive ability is increasingly determined by social class, one can hardly describe British society as more meritocratic.

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Notes

[1]A meritocratic society could be one in which individual success depended purely on other characteristics, such as physical strength. This illustrates the point that the concept of meritocracy is essentially normative and dependent on cultural norms. Our society lauds both effort and intelligence and thus we believe that an individual's status should be determined by these characteristics specifically.

[2]The term 'meritocracy' term was actually coined by Michael Young in his book *The Rise of the Meritocracy* (1958) to warn against a society ridden by stratification according to the results of early childhood testing. It has since been intepreted in many different ways (Breen and Goldthorpe (2001).

[3]See the unresolved debate about the link between genes, intelligence and socio-economic outcomes (Jensen (1968, 1969); Herrnstein and Murray (1994); Goldberger and Manski (1995); Heckman (1995).)

[4]The data used in this paper have already been applied to other aspects of the relationship between socio-economic background, cognitive ability and socio-economic outcomes (Breen and Goldthorpe (1999,2001); Chevalier and Lanot(2002); Currie and Thomas (1999); Dearden (1999a,1999b); Dearden *et al* (1997); Dearden *et al* (2000); Feinstein and Symons (1997) ; Harmon and Walker (2000); McCulloch and Joshi (2000); Saunders (1997)). Blanden *et al* (2002) have also considered intergenerational income mobility in these data. There is also a related literature on social mobility (Erikson and Goldthorpe (1985); Saunders (1997); Breen and Goldthorpe (1999,2001) and McKnight (2000), to cite just a few.

[5]This mainly refers to the National Longitudinal Study of Youth of 1979, but also includes the NLS of the High School Class of 1972 and the High School and Beyond panel

of the class of 1980.

[6]Moreover, the extent of missing data in ability*education cells is subsequently reduced though not eliminated.

[7]Although this conclusion –on earnings– depends on various assumptions made to overcome the problems of making inferences about changes over time with panel data derived from only two cohorts and limited longitudinal observations.

[8]For example, many studies of social mobility are often wrongly interpreted as providing evidence of unmeritocratic trends, on the basis that parental SES strongly determines their offspring's own SES. This is not necessarily the case, to the extent that ability is determined by genes and early environment. Conversely, evidence of weak parental SES effects on wages after conditioning on education is still compatible with little meritocracy in the educational system. In other words if parental social class determines educational attainment, SES may not have any additional effect on wages but society is still unmeritocratic.

[9]There is a substantial literature about the effects of family resources on children's educational attainment and subsequent labour market performance. This literature has focused on the effects of parental income as well as social class and has more recently extended to consider school quality, neighbourhood characteristics, etc. See the literature review by Haveman and Wolfe (1995) on the determinants of children's attainment.

[10]The most widely cited study of this type is the National Longitudinal Survey of Youth (NLSY).

[11]Some of these could be considered as unmeritocratic, such as those following from better living conditions, etc., whereas others are more subject to debate about their nature, such as the transmission of more socially desirable values from parents and so on.

[12]The extent of overlapping in terms of age months for both cohorts is quite considerable, as the data collection process extends itself for periods longer than one year in both surveys.

[13]NCDS test scores at the age of 11 were (i) reading, (ii) maths ability, (iii) non-verbal general ability, (iv) verbal general ability and (v) copying designs. BCS test scores at 10 include (i) maths, (ii) reading and (iii) British Ability Scale test of general ability.

[14]As we will show later, there have been substantial changes in the production of cognitive development between both cohorts over that particular age period.

[15]Most papers using these data (NCDS and BCS) restrict themselves to using the reading and maths quintiles, neglecting important information from the general ability scores. Breen and Goldthorpe (2001) instead argue that the general ability scores in both NCDS and BCS, although different, are a good proxy for IQ scores (Douglas (1967) and Elliot *et al* (1978)). However, Breen and Goldthorpe (2001) ignore potentially important information contained in maths and reading scores.

[16]We do not interpret it as an absolute measure of cognitive skills. The average level of cognitive skills may have increased between cohorts as the result, for example, of increasing levels of schooling or simply increasing focus on testing within the educational establishment. See Flynn (1987).

[17]Copying designs is commonly associated with a more primary type of ability that relates more to brain-motor coordination rather than more elaborate 'cognitive' mental processes.

[18]This supports the hypothesis that the contribution of maths scores to g, for example, is basically the same in NCDS and BCS, and hence we are not treating different components of ability differently across cohorts.

[19]Individuals with just CSEs and lower grade O levels equate, approximately, to high

school dropouts in the US.

[20]5 + O levels equate, approximately, to US high school graduates.

[21]A levels equate, approximately, to high school plus good SAT's or the first year of college.

[22]This category refers to college graduates.

[23]Our results are consistent with Blanden, Gregg and Machin (2002) but differ somewhat from those in Chevalier and Lanot (forthcoming) in that we do find evidence of significant changes in the determinants of education between cohorts. They use a different education measure for the BCS cohort strictly based on the age 26 survey, implemented through a postal self-completion questionnaire and indeed subject to differential attrition relative to the NCDS data. Their specifications also differ: specifically, they only control for reading and maths scores and instead of age 11 NCDS scores, they use age 7 test scores from NCDS that are less comparable to age 10 BCS scores.

[24]If we exclude parental income at 16 to increase the sample size, the role of father's SES differences also appears to become more important. If this same estimation is performed on the reduced sample with valid parental income, the results are basically identical.

[25]This scheme is called the Education Maintenance Allowance, see Dearden *et al* (2002).

[26]Full results available from the authors on request.

[27]We can think of physical and mental health benefits, prestige, happiness, etc.

[28]We have also investigated the role of cognitive ability in occupational choice but we could not find any type of implementable exclusion restriction that allowed identification of a full model of occupational choice as in Cawley *et al* (1998b). Breen and Goldthorpe (2001) argue that there has been a decline in the effects of 'merit' variables, strengthening

the association between class origins and destinations. We prefer to focus our attention on measures of socioeconomic success that are less subject to changes over time in their interpretation as 'success' indicators.

[29]Both dates refer to similar economic circumstances in the British economy, characterised by positive rates of economic growth and declining unemployment rates. Attrition in our data leads to marginally lower rates of unemployment and non-participation relative to the UK economy. Comparisons based on alternative earlier months show similar results and are not displayed here. There is no evidence of differentiated recall problems between cohorts for the purposes of these estimates.

[30]It is of course an arguable point whether this language is appropriate for women choosing to be out of the workforce.

[31]Results are available on request.

[32]Full results are available on request.

[33]Cawley et al (1996) also find that female returns to measured cognitive ability are higher for all racial groups and returns to black males are systematically higher that those of their white and hispanic counterparts. These differences become stronger when controlling for additional characteristics.

[34]This measure is based on the work histories available from cohort members for each month after their sixteenth birthday. We have chosen years of education in this case to ease the depiction of returns over time, though similar results are obtained using highest education level instead.

[35]Detailed cross-tabulations of ability and educational attainment are also available on request.

[36]Thus, for an individual i with education h, age a, cohort c and cognitive ability g within

quartile q, we express $E[\log w_{i,a,c,h,g}] = \alpha_{a,c,q,h} + \beta_{a,c,q,h} \cdot g_i$, with the continuity constraints at $g = g_{0.25}$, $g = g_{0.50}$ and $g = g_{0.75}$. Under this flexible specification, we are able to identify returns to education for NCDS at 33, $E[\log w_{33,NCDS,h',g}] - E[\log w_{33,NCDS,h,g}]$, obtain a lower bound for the unobserved $E[\log w_{33,BCS,h',g}] - E[\log w_{33,BCS,h,g}]$ from $E[\log w_{30,BCS,h',g}] - E[\log w_{30,BCS,h,g}]$ when $h' > h$, for all values of g. A lower bound for changes in returns to education then follows. Similarly, returns to ability for a given educational level can be similarly estimated and their changes lower-bounded, building on the lessons about non-decreasing average returns to ability and education from figure 2.

[37]These have been calculated as the predicted value plus/minus twice the standard error of the prediction.

[38]Large standard errors in these areas reflect this problem too.

[39]Results available on request.

[40]These findings are reproduced by defining social class in terms of parental socioeconomic occupation. These results are available on request.

[41]Results available on request.

[42]Studies on differences between monozygotic twins reared apart are based on the strong assumption of no interactions between genes and environment. Other complications follow from the small sample sizes available, their representativeness and the lack of substantial variation in environments.

[43]Feinstein (forthcoming) also shows that although children are already stratified by social class at early tests (in terms of higher average rank positions for higher SES levels), the stratification becomes more extreme as time passes. The importance of SES seems to be confirmed by the fact that, on average, children from high SES with early low attainment overtake low SES children with higher early attainment in later ability tests.

[44]See also Feinstein, Robertson and Symons (1999).

[45]For NCDS at age 7, children were administered the following tests: (i) 'Southgate reading test' (Southgate), (ii) 'Copying designs test', (iii) 'Draw a man test' (Goodenough), (iv) 'Problem arithmetic' (Pringle), (v) 'Word test'. BCS children were tested at age 5: (i) 'Schonell graded reading test', (ii) 'Copying designs', (iii) 'Human figure drawing', (iv) 'English Picture Vocabulary Test', (v) 'Complete a profile'. The ability index for each cohort was also derived using principal components of these ability scores.

[46]This specification also includes parental income, which refers to age 16, so income should be interpreted as an additional control for permanent family income. Unfortunately, there are no earlier comparable measures of income available in the data. The coefficient on earlier ability is unaffected by different specifications, such as those excluding income at 16.

[47]The number of siblings has a negative impact on cognitive development, whereas parental education and interest in the child's education help improve a child's cognitive performance.

[48]This statement requires that parental SES characteristics are not more related to aspects of ability that can be transmitted to their offspring through genes. This is a less restrictive assumption than other restrictions imposed in the literature. In addition, we also control for parental interest in child's education.

[49]It is possible to extend this discussion by allowing additional controls so that the latter may hold true.

[50]These results are also available upon request.

[51]Currie and Thomas (1995) performed a similar exercise for the U.S.

[52]It is possible that the ability transmission mechanism is different for mothers and

fathers, either for genetic or environmental reasons. Basic correlations by age groups also suggest that the mother's influence is higher. Results available on request.

[53]This variable has a precision of one month. It is important to note that by using data on a single cohort, older children tend to have parents with lower ability scores and less favourable parental socio-economic backgrounds. This effect is combined with the fact that parent-child ability correlations appear to increase with age. To keep things as simple as possible, we have chosen to include the age polynomial and ability variables without any interactions. Instrumenting child age did not produce substantially different results.

[54]Signs for father's SES effect on child's math ability look opposed to what one might have expected, due to substantial sorting between education and occupational class. This result confirms some of the findings by Currie and Thomas (1995) in their study of the effects of mothers' AFQT scores on the results of their children Picture and Vocabulary tests.

[55]Using data from the British Household Panel, which does not include parental ability, Ermisch and Francesconi (2000) find negative effects of maternal work on child's educational attainment.

[56]The grammar school system was designed such that the majority of school children (approximately 80%) would have attended secondary modern schools where they were not expected to stay in education beyond the age of 16. 20% of school children, disproportionately from middle or upper class backgrounds, were sent to grammar schools where they were expected to remain in school at least until age 18 or perhaps stay on into higher education.

Referee Appendix

Table 10: Probability of obtaining a higher education qualification: By income and ability group

Men								
Income	Ability quartiles							
quintiles	Q1 (lowest)		Q2		Q3		Q4 (highest)	
	58	70	58	70	58	70	58	70
Q1	0.028	0.024	0.087	0.198	0.169	0.182	0.353	0.431
(lowest)	178	126	172	101	136	88	133	58
Q2	0.025	0.082	0.094	0.128	0.187	0.198	0.430	0.419
	163	159	139	188	139	192	135	191
Q3	0.024	0.085	0.082	0.211	0.235	0.313	0.452	0.531
	164	59	183	71	179	80	177	96
Q4	0.025	0.045	0.082	0.177	0.208	0.369	0.503	0.630
	118	44	184	79	192	111	195	181
Q5	0.011	0.080	0.181	0.220	0.246	0.397	0.595	0.764
(highest)	93	25	105	50	187	63	257	178

Women								
	Ability quartiles							
	Q1 (lowest)		Q2		Q3		Q4 (highest)	
	58	70	58	70	58	70	58	70
Q1	0.043	0.021	0.045	0.129	0.148	0.175	0.385	0.296
(lowest)	185	140	200	139	182	97	143	54
Q2	0.014	0.083	0.053	0.135	0.180	0.212	0.313	0.487
	145	204	170	230	178	226	147	199
Q3	0.037	0.111	0.107	0.165	0.131	0.327	0.288	0.456
	109	54	169	85	198	98	163	90
Q4	0.026	0.173	0.075	0.248	0.208	0.329	0.319	0.637
	117	52	159	109	212	161	191	146
Q5	0.049	0.150	0.140	0.348	0.293	0.453	0.604	0.770
(highest)	81	20	129	46	205	106	273	174

NOTE: Proportion of individuals in each with a university degree or higher in first row. Number of observations in second row.

Table 11: Probability of obtaining a higher education qualification: By social class and ability group

	Men							
Social class	Ability quartiles							
	Q1 (lowest)		Q2		Q3		Q4 (highest)	
	58	70	58	70	58	70	58	70
Professional	0.000	0.250	0.059	0.400	0.360	0.523	0.765	0.845
	12	8	17	20	50	44	119	142
Intermediate	0.033	0.075	0.105	0.179	0.256	0.363	0.572	0.657
	61	53	105	84	168	124	283	236
Skilled non-manual	0.053	0.119	0.071	0.222	0.212	0.341	0.506	0.561
	75	59	99	108	132	164	174	244
Skilled manual	0.026	0.063	0.096	0.154	0.171	0.231	0.375	0.426
	531	506	605	505	596	497	501	432
Semi-skilled	0.017	0.067	0.075	0.117	0.178	0.182	0.302	0.398
	174	195	147	162	107	148	106	108
Unskilled	0.013	0.047	0.096	0.086	0.131	0.081	0.404	0.194
	154	106	104	58	61	37	52	31
	Women							
Social class	Q1 (lowest)		Q2		Q3		Q4 (highest)	
	58	70	58	70	58	70	58	70
Professional	0.000	0.167	0.095	0.536	0.443	0.571	0.688	0.794
	3	6	21	28	61	56	112	136
Intermediate	0.030	0.204	0.141	0.196	0.235	0.392	0.510	0.653
	33	49	92	107	179	153	312	245
Skilled non-manual	0.056	0.148	0.109	0.218	0.188	0.273	0.445	0.611
	54	61	101	119	138	183	155	198
Skilled manual	0.026	0.093	0.068	0.139	0.179	0.241	0.373	0.451
	465	485	635	606	698	573	502	412
Semi-skilled	0.021	0.070	0.071	0.161	0.139	0.213	0.265	0.344
	146	187	154	199	151	155	102	93
Unskilled	0.041	0.044	0.068	0.130	0.159	0.055	0.270	0.200
	146	91	132	69	82	55	37	25

NOTE: Proportion of individuals in each with a university degree or higher in first row. Number of observations in second row.

Table 12: Returns to qualifications and ability: NCDS

	NCDS-MEN(23)				NCDS-MEN(33)				NCDS-MEN(42)			
	Basic		Extended		Basic		Extended		Basic		Extended	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Aca.NVQ1	0.044	*0.024*	0.022	*0.023*	0.129	*0.024*	0.097	*0.025*	0.132	*0.026*	0.099	*0.026*
Aca.NVQ2	0.083	*0.022*	0.027	*0.020*	0.222	*0.023*	0.134	*0.025*	0.245	*0.024*	0.148	*0.025*
Aca.NVQ3	0.140	*0.029*	0.054	*0.027*	0.375	*0.035*	0.244	*0.038*	0.475	*0.038*	0.322	*0.041*
Aca.NVQ4	0.120	*0.026*	0.025	*0.026*	0.449	*0.027*	0.307	*0.031*	0.485	*0.031*	0.322	*0.035*
Aca.NVQ5	0.138	*0.043*	0.044	*0.043*	0.477	*0.038*	0.323	*0.042*	0.672	*0.057*	0.486	*0.059*
Voc.NVQ1	0.002	*0.024*	-0.003	*0.023*	-0.010	*0.025*	-0.017	*0.025*	0.000	*0.028*	-0.002	*0.028*
Voc.NVQ2	0.040	*0.020*	0.039	*0.019*	-0.001	*0.023*	0.001	*0.023*	-0.047	*0.026*	-0.043	*0.025*
Voc.NVQ3	0.049	*0.020*	0.044	*0.020*	0.014	*0.022*	0.006	*0.022*	0.025	*0.026*	0.018	*0.026*
Voc.NVQ4	0.032	*0.017*	0.025	*0.017*	0.098	*0.021*	0.085	*0.021*	0.079	*0.024*	0.071	*0.024*
Voc.NVQ5	-0.041	*0.070*	-0.047	*0.068*	-0.028	*0.085*	-0.017	*0.084*	-0.205	*0.072*	-0.185	*0.070*
FatEdMid	-0.020	*0.025*	-0.028	*0.024*	0.033	*0.024*	0.019	*0.024*	0.054	*0.031*	0.030	*0.031*
FatEdHig	-0.020	*0.030*	-0.019	*0.030*	0.117	*0.033*	0.119	*0.032*	0.072	*0.040*	0.068	*0.040*
MotEdMid	-0.003	*0.022*	-0.014	*0.022*	0.039	*0.024*	0.024	*0.023*	0.020	*0.028*	-0.001	*0.028*
MotEdHig	-0.034	*0.037*	-0.042	*0.037*	-0.030	*0.051*	-0.046	*0.052*	0.080	*0.050*	0.073	*0.050*
SES I	-0.029	*0.039*	-0.047	*0.039*	0.101	*0.044*	0.074	*0.043*	0.115	*0.068*	0.082	*0.067*
SES II	-0.068	*0.029*	-0.080	*0.030*	0.019	*0.034*	-0.002	*0.033*	0.001	*0.036*	-0.034	*0.035*
SES III.1	0.003	*0.023*	-0.008	*0.022*	0.082	*0.031*	0.060	*0.030*	0.031	*0.035*	0.003	*0.034*
SES III.2	0.026	*0.018*	0.021	*0.018*	0.013	*0.023*	0.002	*0.022*	-0.023	*0.026*	-0.037	*0.026*
SES IV	-0.021	*0.023*	-0.021	*0.023*	-0.057	*0.030*	-0.062	*0.030*	-0.113	*0.033*	-0.120	*0.033*
C.ability			0.050	*0.011*			0.077	*0.010*			0.098	*0.012*
Antis.			-0.022	*0.007*			-0.031	*0.008*			-0.029	*0.009*
Interc.	1.654	*0.025*	1.710	*0.022*	1.916	*0.028*	2.004	*0.029*	2.031	*0.032*	2.131	*0.033*
Observ.	2995		2995		2767		2767		3385		3385	
R-Sq.	0.025		0.042		0.203		0.229		0.188		0.213	

NOTE: Dependent variable: Log hourly wages. OLS estimates. Sample of working men in each sweep. Baseline category: No qualifications, unskilled manual father and parents without any qualification.

Table 13: Returns to qualifications and ability: BCS

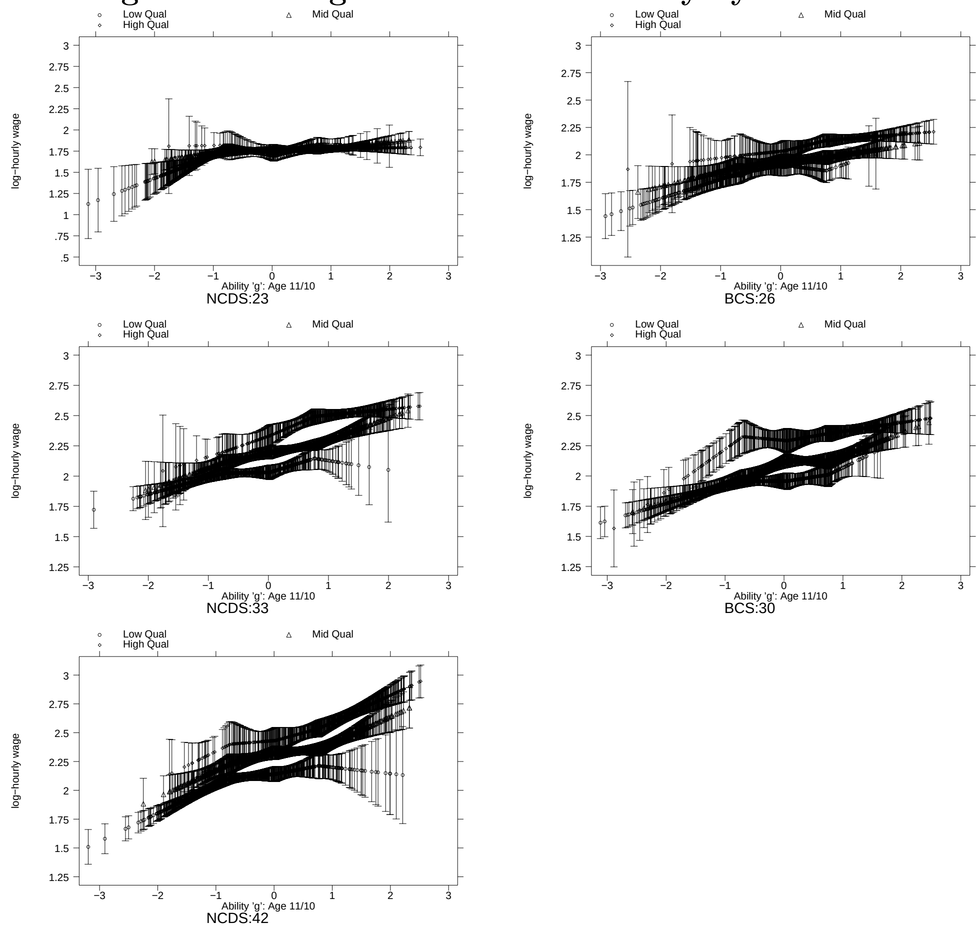
	BCS-MEN(21)				BCS-MEN(26)				BCS-MEN(30)			
	Basic		Extended		Basic		Extended		Basic		Extended	
	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.	Coef.	R.S.E.
Aca.NVQ1	-0.099	*0.077*	-0.073	*0.077*	0.024	*0.046*	0.005	*0.046*	0.033	*0.025*	0.024	*0.025*
Aca.NVQ2	0.029	*0.064*	0.021	*0.063*	0.119	*0.041*	0.064	*0.041*	0.121	*0.022*	0.065	*0.023*
Aca.NVQ3	0.226	*0.104*	0.191	*0.099*	0.175	*0.056*	0.084	*0.057*	0.276	*0.037*	0.172	*0.039*
Aca.NVQ4	0.125	*0.082*	0.097	*0.081*	0.244	*0.043*	0.156	*0.045*	0.354	*0.029*	0.258	*0.031*
Aca.NVQ5	-0.272	*0.080*	-0.408	*0.101*	0.266	*0.055*	0.156	*0.058*	0.398	*0.040*	0.270	*0.043*
Voc.NVQ1	-0.049	*0.080*	-0.068	*0.079*	-0.057	*0.030*	-0.060	*0.030*	-0.022	*0.025*	-0.026	*0.025*
Voc.NVQ2	-0.094	*0.065*	-0.088	*0.064*	-0.036	*0.033*	-0.020	*0.034*	-0.041	*0.023*	-0.030	*0.023*
Voc.NVQ3	0.026	*0.056*	0.020	*0.056*	-0.020	*0.032*	-0.015	*0.032*	0.040	*0.025*	0.037	*0.024*
Voc.NVQ4	-0.037	*0.064*	-0.034	*0.064*	0.035	*0.028*	0.034	*0.027*	0.075	*0.027*	0.072	*0.026*
Voc.NVQ5	-0.549	*0.143*	-0.569	*0.139*	-0.201	*0.059*	-0.209	*0.057*	-0.169	*0.059*	-0.197	*0.060*
FatEdMid	-0.082	*0.049*	-0.086	*0.050*	0.049	*0.028*	0.044	*0.028*	0.060	*0.029*	0.051	*0.029*
FatEdHig	0.061	*0.079*	0.064	*0.079*	0.063	*0.038*	0.055	*0.037*	0.030	*0.043*	0.028	*0.043*
MotEdMid	0.032	*0.048*	0.023	*0.048*	0.071	*0.029*	0.061	*0.029*	0.061	*0.028*	0.041	*0.028*
MotEdHig	-0.014	*0.160*	-0.028	*0.164*	0.063	*0.042*	0.046	*0.042*	0.022	*0.045*	-0.001	*0.044*
SES I	-0.008	*0.145*	-0.024	*0.148*	0.070	*0.057*	0.045	*0.057*	0.120	*0.050*	0.079	*0.050*
SES II	-0.065	*0.123*	-0.082	*0.126*	0.047	*0.041*	0.024	*0.041*	0.091	*0.040*	0.060	*0.040*
SES III.1	-0.005	*0.089*	-0.030	*0.090*	0.086	*0.039*	0.069	*0.039*	0.126	*0.034*	0.097	*0.034*
SES III.2	0.046	*0.077*	0.038	*0.076*	0.049	*0.036*	0.041	*0.036*	0.052	*0.028*	0.043	*0.027*
SES IV	-0.006	*0.086*	-0.016	*0.086*	-0.029	*0.043*	-0.027	*0.043*	0.020	*0.032*	0.016	*0.031*
C.ability			0.044	*0.027*			0.066	*0.013*			0.085	*0.010*
Antis.			-0.030	*0.021*			-0.012	*0.011*			-0.008	*0.008*
Interc.	1.821	*0.083*	1.840	*0.081*	1.778	*0.049*	1.831	*0.049*	1.865	*0.030*	1.930	*0.030*
Observ.	333		333		2196		2196		3017		3017	
R-Sq.	0.085		0.100		0.077		0.089		0.145		0.166	

NOTE: OLS estimates. Sample of men at work in each sweep. Baseline category: No qualifications, unskilled manual father and parents without any qualification.

Table 14: Probability of staying in original ability quartile: Cohort changes in SES gap.

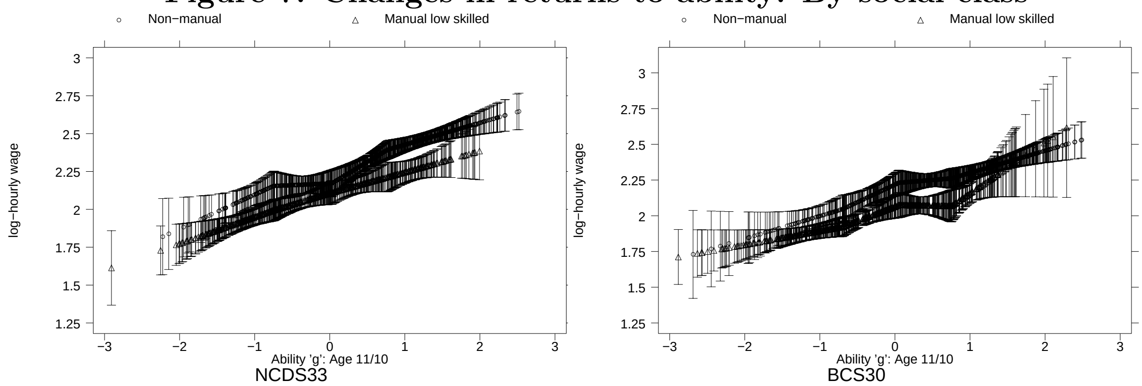
Children in lowest ability quartile at 7/5			
	Comparison	Boys	Girls
Father's Social Class	Prof *vs* Unskilled	-0.037	-0.253
		(0.178)	(0.198)
	Intermediate *vs* Semi-skilled	0.146	0.034
		(0.0735)	(0.087)
	Skilled man *vs* non manual	0.084	-0.014
		(0.073)	(0.088)
Parental Income Quintiles	Top *vs* bottom quintiles	0.260	0.488
		(0.105)	(0.087)
	Second *vs* fourth quintiles	0.129	0.0523
		(0.071)	(0.094)
Children in highest ability quartile at 7/5			
		Boys	Girls
Father's Social Class	Prof *vs* Unskilled	0.208	0.242
		(0.116)	(0.107)
	Intermediate *vs* Semi-skilled	0.082	0.060
		(0.239)	(0.059)
	Skilled man *vs* non manual	0.082	0.061
		(0.058)	(0.059)
Parental Income Quintiles	Top *vs* bottom quintiles	0.146	0.087
		(0.087)	(0.086)
	Second *vs* fourth quintiles	0.102	0.046
		(0.075)	(0.073)

Figure 6: Changes in returns to ability by education: All surveys



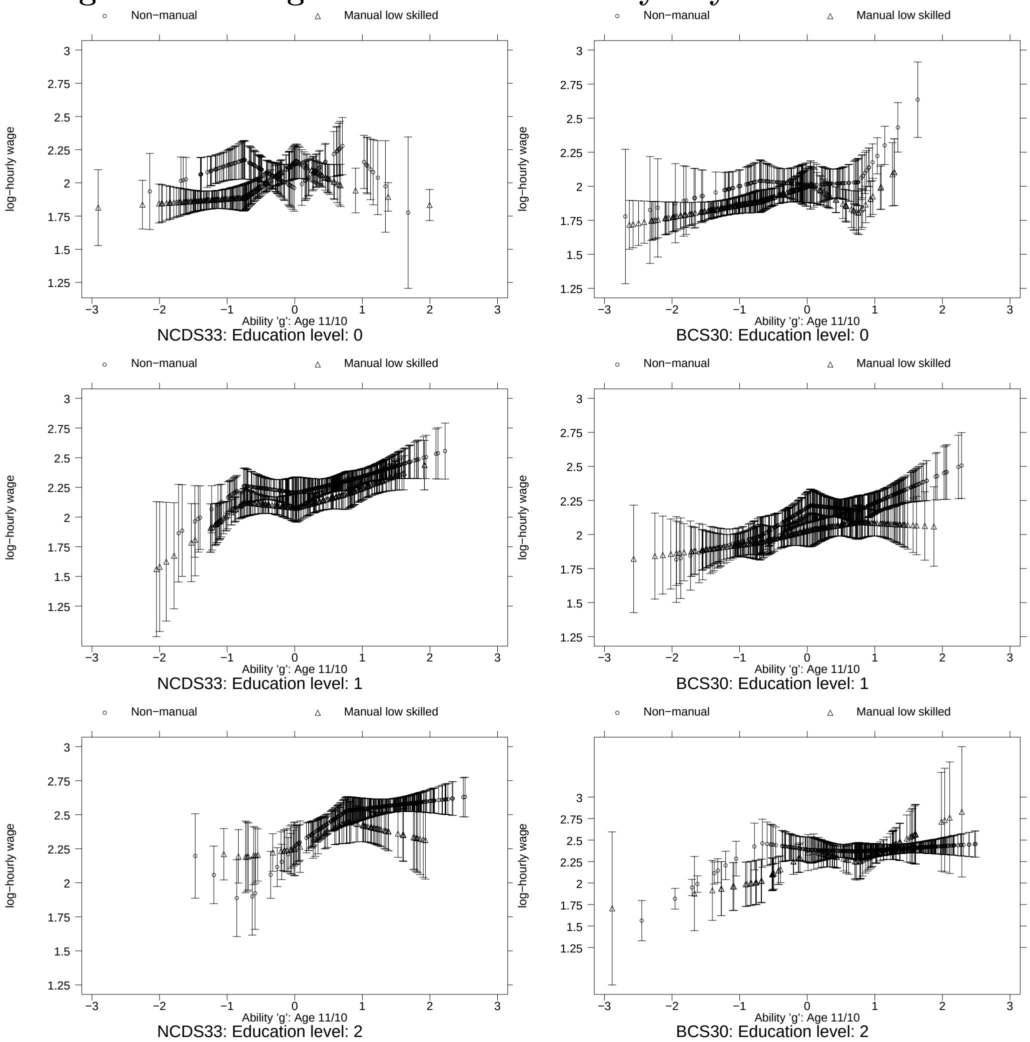
NOTES: Based on spline regression of log hourly real wages (pr=Jan 2001) on g calculated from ability scores at the age of 11(10), by highest level of academic qualification. Sample: Working males with valid wage, ability and qualifications data.

Figure 7: Changes in returns to ability: By social class



NOTES: Based on spline regression of log hourly real wages (pr=Jan 2001) on g calculated from ability scores at the age of 11(10), by highest level of academic qualification. Sample: Working males with valid wage, ability and qualifications data. Individuals with father in non-manual occupations compared to children of mid and low-skilled manual workers.

Figure 8: Changes in returns to ability: By education and social class



NOTE: Based on spline regression of log hourly real wages (pr=Jan 2001) on g calculated from ability scores at the age of 11(10), by highest level of academic qualification. Sample: Working males with valid wage, ability and qualifications data. Same class groups as in figure 7.

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