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ACCOUNTING FOR INTERGENERATIONAL INCOME PERSISTENCE: NONCOGNITIVE SKILLS, ABILITY AND EDUCATION*

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We analyse in detail the factors that lead to intergenerational persistence among sons, where this is measured as the association between childhood family income and later adult earnings. We seek to account for the level of income persistence in the 1970 BCS cohort and also to explore the decline in mobility in the UK between the 1958 NCDS cohort and the 1970 cohort. The mediating factors considered are cognitive skills, non-cognitive traits, educational attainment and labour market attachment. Changes in the relationships between these variables, parental income and earnings are able to explain over 80% of the rise in intergenerational persistence across the cohorts.

Intergenerational mobility is the degree of fluidity between the socio-economic status of parents (usually measured by income or social class) and the socio-economic outcomes of their children as adults. A strong association between incomes across generations indicates weak intergenerational income mobility, and may mean that those born to poorer parents have restricted life chances and do not achieve their economic potential.

Recent innovations in research on intergenerational mobility have been concentrated on improving the measurement of the extent of intergenerational mobility, and on making comparisons across time and between nations. The evidence suggests that the level of mobility in the UK is low by international standards (Jäntti *et al.*, 2006; Corak, 2006; Solon, 2002). Comparing the 1958 and 1970 cohorts indicates that mobility has declined in the UK (Blanden *et al.*, 2004).

This article takes this research a stage further by focusing on transmission mechanisms; those variables that are related to family incomes and have a return in the labour market. First we evaluate the relative importance of education, ability, noncognitive (or 'soft') skills and labour market experience in generating the extent of intergenerational persistence in the UK among the 1970 cohort. In the second part of the article we seek to appreciate how these factors have contributed to the observed decline in mobility in the UK. We focus here on men for reasons of brevity.

Education is the most obvious of these transmission mechanisms. It is well established that richer children obtain better educational outcomes, and that those with higher educational levels earn more. Education is therefore a prime candidate to explain mobility and changes in it. Indeed, Blanden *et al.* (2004) find that a strengthening relationship between family income and participation in post compulsory schooling across cohorts can help to explain part of the fall in intergenerational mobility they observe.

Cognitive ability determines both educational attainment and later earnings, making it another likely contributor to intergenerational persistence. We might expect a strong link between parental income and measured ability, both because of biologically inherited intelligence and due to the investments that better educated parents can

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make in their children. We seek to understand the extent to which differing achievements on childhood tests across income groups can explain differences in earnings, both directly, and through their relationship with final educational attainment. Galindo-Rueda and Vignoles (2005) demonstrate that the role of cognitive test scores in determining educational attainment has declined between these two cohorts.

A growing literature highlights that noncognitive personality traits and personal characteristics earn rewards in the labour market and influence educational attainment and choices (Feinstein, 2000; Heckman *et al.*, 2006; Bowles *et al.*, 2001; Carneiro *et al.*, 2006). If these traits are related to family background then this provides yet another mechanism driving intergenerational persistence. Osborne–Groves (2005) considers this possibility explicitly and finds that 11% of the father–son correlation in earnings can be explained by the link between personalities alone; where personality is measured only by personal efficacy.

Finally, labour market experience and employment interruptions have long been found to influence earnings (Stevens, 1997). Gregg and Tominey (2005) highlight, in particular, the negative impacts of spells of unemployment as young adults; we therefore analyse labour market attachment as another way in which family background might influence earnings.

In the next Section we lay out our modelling approach in more detail. Section 2 discusses our data. Section 3 presents our results on accounting for the level of intergenerational mobility while Section 4 describes our attempt to understand the change. Section 5 offers conclusions.

1. Modelling Approach

In economics, the empirical work on intergenerational mobility is generally concerned with the estimation of β in the following regression;

$$\ln Y_i^{child} = \alpha + \beta \ln Y_i^{parents} + \varepsilon_i \tag{1}$$

where $\ln Y_i^{child}$ is the log of some measure of earnings or income for adult children, and $\ln Y_i^{parents}$ is the log of income for parents, i identifies the family to which parents and children belong and ε_i is an error term. β is therefore the elasticity of children's income with respect to their parents' income and $(1 - \beta)$ can be thought of as measuring intergenerational mobility.

Conceptually, we are interested in the link between the permanent incomes of parents and children across generations. However, the measures of income available in longitudinal datasets are likely to refer to current income in a period. In some datasets multiple measures of current income can be averaged for parents and children, moving the measure somewhat closer to permanent income. Additionally it is usual to control for the ages of both generations.[1] In the cohort datasets we use, substantial measurement error is likely to remain, meaning that our estimates will be biased downwards as measures of intergenerational persistence. The issue of measurement error becomes particularly important when considering the changes in mobility across cohorts and this will be returned to when discussing our findings.

[1] Solon (1999) provides a review of the evolution of the intergenerational mobility literature.

We report the intergenerational partial correlation r, alongside β because differences in the variance of $\ln Y$ between generations will distort the β coefficient. This is obtained simply by scaling β by the ratio of the standard deviation of parents' income to the standard deviation of children's income, as shown below.

$$r = \mathrm{Corr}_{\ln \mathbf{Y}^{\mathrm{parents}}, \ln \mathbf{Y}^{child}} = \beta \left(\frac{SD^{\ln Y^{parents}}}{SD^{\ln Y^{child}}} \right). \tag{2}$$

The main objective in this article is to move beyond the measurement of β and r, and to understand the pathways through which parental income affects children's earnings. The role of non-cognitive skills can be used as an example, assuming for the moment that these are measured as a single index. We can measure the extent to which these skills are related to parental income $Noncog_i = \alpha_1 + \lambda \ln Y_i^{parents} + \varepsilon_{1i}$, and estimate their pay-offs in the labour market $\ln Y_i^{child} = \varpi_1 + \rho Noncog_i + u_{1i}$

This means that the overall intergenerational elasticity can be decomposed into the return to non-cognitive skills multiplied by the relationship between parental income and these skills, plus the unexplained persistence in income that is not transmitted through non-cognitive traits.

$$\beta = \rho\lambda + \frac{\mathrm{Cov}(u_{1i}, \ln Y_i^{parents})}{\mathrm{Var}(\ln Y_i^{parents})}. \tag{3}$$

In our analysis we consider non-cognitive skills among several other mediating factors: cognitive test scores, educational performance and early labour market attachment.

Our decomposition approach requires the estimation of the univariate relationships between the transmission variables and parental income. These are then combined with the returns found for those variables in an earnings equation. We build up the specifications of our earnings equations gradually, as we believe that many of the associations operate in a sequential way. For example, Heckman *et al.* (2006) show that part of the advantage of higher non-cognitive skills works through enabling children to reach a higher education level. In the previous example we have shown the unconditional influence of non-cognitive skills on intergenerational persistence. To see how non-cognitive skill works through education levels, we can add education to the earnings equation.

$$\ln Y_i^{child} = \varpi_2 + \delta Noncog_i + \pi Ed_i + u_{2i}. \tag{4}$$

Then estimate the relationship between educational attainment and parental income.

$$Ed_i = \alpha_2 + \gamma \ln Y_i^{parents} + \varepsilon_{2i}. \tag{5}$$

The conditional decomposition is then:

$$\beta = \delta\lambda + \pi\gamma + \frac{\mathrm{Cov}(u_{2i}, \ln Y_i^{parents})}{\mathrm{Var}(\ln Y_i^{parents})}. \tag{6}$$

Where $\delta\lambda$ is the conditional contribution of non-cognitive skill and $\pi\gamma$ is the contribution of age 16 examination results. Therefore the difference between $\rho\lambda$ and $\delta\lambda$

shows the extent to which the non-cognitive skills contribute to intergenerational persistence by enabling more affluent children to achieve better qualifications at 16.

In the second part of this study we use the same approach to account for the change in intergenerational persistence. If we continue with the simple example shown above, we can write

$$\beta_{70} - \beta_{58} = \delta_{70}\lambda_{70} - \delta_{58}\lambda_{58} + \pi_{70}\gamma_{70} - \pi_{58}\gamma_{58} + \frac{\mathrm{Cov}(u_{2i70}, \ln Y_{i70}^{parents})}{\mathrm{Var}(\ln Y_{i70}^{parents})} - \frac{\mathrm{Cov}(u_{2i58}, \ln Y_{i58}^{parents})}{\mathrm{Var}(\ln Y_{i58}^{parents})}. \quad (7)$$

Or in words, the difference in persistence is formed of two parts; the difference between the explained persistence across the cohorts plus the difference between the unexplained persistence. If the explained part of β is larger in the second cohort than in the first then this indicates that the factors we explore are responsible for part of the increase in intergenerational persistence.

2. Data

We use information from the two mature publicly accessible British cohort studies, the British Cohort Study (BCS) of those born in 1970 and the National Child Development Study (NCDS) of those born in 1958. Both cohorts began with around 9,000 baby boys, although as we shall see our final samples are considerably smaller than this. We shall first provide a discussion of how we use the 1970 cohort, before considering how the data are used in the comparative Section of the article.

2.1. *British Cohort Study*

The BCS originally included all those born in Great Britain between 4th and 11th April 1970. Information was obtained about the sample members and their families at birth and at ages 5, 10, 16 and 30. We use the earnings information obtained at age 30 as the dependent variable in our intergenerational models. Employees are asked to provide information on their usual pay and pay period. Data quality issues mean we must drop the self-employed. Parental income is derived from information obtained at age 10 and 16; where parents are asked to place their usual total income into the appropriate band (there were seven options at age 10 and eleven at age 16). We generate continuous income variables at each age by fitting a Singh-Maddala distribution to the data using maximum likelihood estimation. This is particularly helpful in allocating an expected value for those in the open top category.[2] We adjust the variables to net measures and impute child benefit for all families.[3] The explanatory variable used in the first part of the article is the average of income over ages 10 and 16.

[2] Singh and Maddala (1976). Many thanks to Christopher Crowe for providing his stata program smint.ado which fits Singh-Maddala distributions to interval data.

[3] The distribution of the income variables obtained compares reassuringly with incomes for similarly defined families in the same years of the Family Expenditure Surveys, figures showing this are available from the authors on request.

Box 1

Non-cognitive Variables in BCS

Mother and teacher-reported scales are formed from principal components analyses of the following behavioural ratings. The respondent grades the incidence of the behaviour in the child along a 1–100 scale, where the definitions of 1 and 100 vary according to the behaviour being described.
Mother reported at age 5:
Anti-social: disobedient, destructive, aggressive, irritable, restless and tantrum
Neurotic: miserable, worried, fearful, fussy and complains of aches and pains
Teacher reported variables from age 10: scales are formed according to the suggestions made in Osborn and Milbank (1987).
Application: 15 items, including the child's concentration and perseverance and his/her ability to understand and complete complex tasks.
Clumsiness: 12 items, includes items on bumping into things, and the use of small objects such as scissors.
Extroversion: 6 items concerning talkativeness and an explicit question about extroversion.
Hyperactivity: 6 items, includes the items squirmy, excitable, twitches, hums and taps.
Anxious: 9 items, includes items very similar to those which generate the mother reported anxiety scale.*
Child reported variables at age 10:
Locus of control: CAROLOC score for locus of control (Gammage, 1975).
Self-esteem: LAWSEQ score for self-confidence (Lawrence, 1973, 1978).
Mother-reported variable at age 16:
Anxiety: Derived from a principal components analysis of the mother's reports of the applicability to the child of the following descriptions: worried; solitary; miserable; fears new; fussy; obsessed with trivia; sullen; and cries for little cause.

*Osborn and Milbank (1987) include two further scales; peer relations and conduct disorder, but we do not include these in our analysis as we find they have no relationship with earnings.

In the childhood surveys parents, teachers and the children themselves are asked to report on the child's behaviour and attitudes. These responses are combined to form the noncognitive measures as described in Box 1. Information on cognitive skills is obtained at age 5 from the English Picture Vocabulary test (EPVT) and a copying test. At age 10 the child took part in a reading test, maths test and British Ability Scale test (close to an IQ test). Exam results at age 16 were obtained from information given in the age 26 sub-sample and the age 30 sample. This includes detailed information on the number of exams passed (both GCE O-level and CSE). Information on educational achievements beyond age 16 is also available from the age 30 sample, as is information on all periods of labour market and educational activity from age 16 to 30. This information is used to generate the measures of labour market attachment which are the proportion of months from age 16 to 30 when the individual is out of education, out of the labour force and unemployed.

2.2. *Comparative Data on the Two Cohorts*

Some modifications must be made to the variables used when comparing the BCS with the earlier National Child Development Study (NCDS). The NCDS obtains data at birth and ages 7, 11, 16, 23, 33 and 42 for children born in a week in March 1958. Parental income data is available only at age 16, meaning that the comparative analysis of this data is based only on income at this age. The questions that ask about parental income in the two cohorts are not identical and adjustments must be made to account for differences in the way income is measured; see Blanden (2005, Chapter 4) for full details. Intergenerational parameters for the NCDS are obtained by regressing earnings

at age 33 on this parental income measure. Comparative results for the BCS are generated by regressing earnings at 30 on parental income at age 16.

Careful consideration is needed when using the noncognitive variables to make comparisons across the cohorts. In both cohorts, mothers are asked a number of items from the Rutter A scale – this is the version of the Rutter behaviour scale which is asked of parents (Rutter *et al.*, 1970). Indicators of internalising behaviour from the Rutter scale included in both cohorts are headaches, stomach aches, sleeping difficulties, worried and fearful, at ages 11/10. Externalising behaviours are fidget, destructive, fights, irritable and disobedient at the same age. Principal components analysis is used to form these variables into two scales, we refer to these as the Rutter externalising and Rutter internalising scales.[4]

The teacher-reported variables in the NCDS are from the Bristol Social Adjustment Guide (Stott, 1966, 1971). The teacher was given a series of phrases and asked to underline those that he/she thought applied to the child. The phrases were grouped into 11 different behavioural 'syndromes'. We have investigated the extent to which these syndromes are comparable with the scales derived from the teacher measures in the BCS, and our strict comparability criteria mean that we can only use some of the information available in each cohort. Together with the internalising and externalising Rutter scales, we use BCS hyperactivity as comparable with the NCDS restless subscale and application (BCS) matched with inconsequential behaviour (NCDS). These measures are based on similar questions and the pairs of non-cognitive measures have very similar correlations with mother's smoking and adult health measures.[5]

For cognitive skills; reading, maths and general ability scores at age 11 are broadly comparable with the reading, maths and British Ability Scale scores in the BCS. These variables were also used on a comparative basis by Galindo-Rueda and Vignoles (2005). Information on exam results at 16 and 18 is obtained from a survey of all schools attended by the cohort members carried out in 1978. As less detail is given concerning the grades obtained in individual subjects than is available for the BCS cohort, O level or CSE points for Maths and English are added together as the measure of exam success at age 16 (i.e. a grade A is allocated five points, a B four points etc). Information on later education attainments is derived from the age 23 and 33 surveys for the NCDS, and the data on labour market attachment is taken from the work history information collected in the age 33 and 42 surveys. It refers to the period between ages 16 and 33.

3. Accounting for Intergenerational Persistence

3.1. *Estimates of Intergenerational Persistence*

Table 1 details the estimates of intergenerational mobility that we attempt to understand in the first part of this article, providing the intergenerational coefficient and the intergenerational partial correlation. The estimates presented are based on the average

[4] The NCDS variables in this Section are coded into three categories 'never, sometimes, frequently' while the BCS variables are coded as a continuous scale. We therefore recode the BCS variables as three categories based on the assumption that the proportion in the each category is the same as in the earlier cohort.

[5] Full details of our methods for choosing comparable scales are available on Jo Blanden's webpage at http://www.econ.surrey.ac.uk/.

Table 1

Intergenerational Persistence Among Sons in the 1970 Cohort

Regression of Earnings at Age 30 on Average Family Income at age 10/16		
β	Partial Correlation (r)	Sample Size
0.3204 (0.0218)	0.2729 (0.0186)	3,340

Note: β and r are from a regression of earnings at age 30 on average parental income at ages 16 and 10. The sample is formed from all those who have a parental income observation at either of these ages, dummy variables are included for those cases where one income report is missing.

of age 10 and age 16 parental income and are conditional on average parental age and age-squared. The coefficient is 0.32 while the partial correlation is a little smaller at 0.27. This estimate is slightly higher than those obtained when using income data from a single period (see Table 4) but is still likely to understate the level of persistence compared to using many years of parental income, as in Mazumder (2001), or by predicting permanent income, as in Dearden *et al.* (1997). This, however, is the best estimate from this data that is suitable for decomposition.

3.2. *Decomposing Intergenerational Persistence*

The first stage in understanding which factors mediate intergenerational persistence is to review which of them has a relationship with parental income, as without this link they cannot play a role in our explanation. The first column of Table 2 provides the results from regressions of each variable[6] on parental income, conditional on parental age, as in the intergenerational regression. With the exception of the mother's neurotic rating at age 5 all the variables we have chosen as possible mediating factors are strongly related to parental income. Better off children have better noncognitive traits, and perform better in all cognitive tests. As they grow up they achieve more at all levels of education and have greater labour market attachment in their teens and 20s.

Our results show that the cognitive variables have stronger associations with parental income than the noncognitive variables. The noncognitive and cognitive variables have all been scaled to have a mean of 0 and a standard deviation of 1 the coefficients therefore indicate the proportionate standard deviation change associated with a 100% increase in family income. Application and locus of control have the strongest association with parental income among the noncognitive variables, and for these variables the magnitude of this association, at 0.3, is similar to the 0.3–0.5 coefficients found for the cognitive variables.

For any factor to be influential in describing intergenerational correlations, it must be both related to family background and have significant rewards in the labour market. The remainder of Table 2 builds up the sequential earnings equations; these show how the early measures of cognitive and noncognitive skill impact on earnings

[6] Descriptive statistics for the all the variables are available from Jo Blanden's webpage at http://www.econ.surrey.ac.uk/.

Table 2

Relationships Between Mediating Variables, Earnings and Family Income, 1970 Cohort

	Family income	(1)	(2)	(3)	(4)	(5)	(6)
Non-cognitive							
Anti social5	−0.237	−0.031		−0.015	−0.005	−0.003	−0.001
	(0.037)***	(0.009)***		(0.009)	(0.009)	(0.009)	(0.009)
Neurotic5	0.001	0.022		0.014	0.010	0.007	0.008
	(0.035)	(0.010)**		(0.010)	(0.009)	(0.009)	(0.009)
Locus of control 10	0.297	0.060		0.031	0.021	0.021	0.021
	(0.038)***	(0.009)***		(0.010)***	(0.010)**	(0.010)**	(0.009)**
Self esteem 10	0.227	0.020		0.016	0.013	0.010	0.007
	(0.037)***	(0.009)**		(0.009)*	(0.009)	(0.009)	(0.009)
Application 10	0.294	0.089		0.047	0.020	0.017	0.010
	(0.037)***	(0.011)***		(0.012)***	(0.012)*	(0.012)	(0.011)
Clumsy 10	−0.154	−0.034		−0.023	−0.029	−0.033	−0.034
	(0.037)***	(0.011)***		(0.010)**	(0.010)***	(0.010)***	(0.010)***
Extrovert 10	0.126	0.022		0.021	0.022	0.023	0.022
	(0.040)***	(0.010)**		(0.010)**	(0.010)**	(0.010)**	(0.010)**
Hyperactive 10	−0.133	0.023		0.017	0.015	0.015	0.014
	(0.041)***	(0.011)**		(0.010)	(0.010)	(0.010)	(0.010)
Anxious 10	−0.103	0.011		0.007	0.004	0.004	0.002
	(0.039)**	(0.011)		(0.010)	(0.010)	(0.010)	(0.010)
Anxious 16	−0.066	−0.039		−0.033	−0.033	−0.037	−0.028
	(0.033)**	(0.014)***		(0.014)**	(0.014)**	(0.013)***	(0.013)**
Cognitive							
Epvt 5	0.365		0.024	0.018	0.009	0.011	0.007
	(0.034)***		(0.010)**	(0.010)*	(0.010)	(0.010)	(0.010)
Copy 5	0.383		0.054	0.046	0.030	0.027	0.024
	(0.037)***		(0.010)***	(0.010)***	(0.009)***	(0.009)***	(0.009)***
Reading 10	0.464		0.035	0.016	0.023	−0.002	−0.000
	(0.037)***		(0.013)***	(0.013)	(0.013)	(0.013)	(0.013)
Maths 10	0.479		0.081	0.058	0.029	0.022	0.015
	(0.036)***		(0.014)***	(0.014)***	(0.013)**	(0.013)*	(0.013)
British ability scale 10	0.435		0.021	0.019	0.010	0.006	0.010
	(0.041)***		(0.012)*	(0.012)	(0.012)	(0.011)	(0.011)
Education at 16							
No. of O-levels	1.886				0.036	0.018	0.016
	(0.121)***				(0.003)***	(0.004)***	(0.004)***
Post-16 education							
No. of A-levels	0.622					0.025	0.029
	(0.052)***					(0.010)**	(0.010)***
Staying on post 16	0.330					0.029	0.021
	(0.019)***					(0.021)	(0.020)
Degree	0.250					0.152	0.165
	(0.018)***					(0.025)***	(0.024)***
Staying on post 18	0.233					−0.002	0.016
	(0.017)***					(0.027)	(0.026)
Labour market attachment							
Time spent unemployed	−0.023						−1.215
	(0.004)***						(0.108)***
Time spent other	−0.006						−0.314
	(0.006)						(0.059)***
R-squared		0.09	0.10	0.12	0.17	0.19	0.24

Notes. Column 1 includes the results from individual regressions of the characteristics in the rows on parental income. The remaining columns are the results from regressions of earnings at age 30 on the characteristics. ***, **, * Indicate significance at the 99%, 95%, 90% confidence levels respectively.

and how these relationships operate though education and labour market attachment. Columns [1] and [2] compare the predictive power of the cognitive test variables with those for non-cognitive indices. The explanatory power of these two specifications is very close with an R-squared of 0.09 for the non-cognitive variables and 0.10 for the cognitive variables. When both sets of variables are included in regression [3], the explanatory power of the model increases only marginally, implying that the two sets of variables are predicting the same earnings variation across individuals.

The strongest association with earnings among the cognitive variables are for copying at age 5 and maths at age 10. The results suggest that, conditional on the other non-cognitive and cognitive scales, a standard deviation increase in the copying score at age 5 is associated with 4.6% increase in earnings, whilst for the maths score this is 5.4%. The application and locus of control scores at age 10 and anxiety at age 16 have the largest earnings returns among the non-cognitive variables, with 4.7%, 3.1% and −3.3% extra earnings associated with a one standard deviation increase respectively.[7] Specification [4] adds the number of O-levels at grades A–C (or equivalent) obtained at age 16 to the regression. As would be expected the number of O-levels is a strong predictor of earnings, with each O-level associated with a 3.6% increase in earnings. Introducing the O-levels variable reduces the strength of the coefficients for the non-cognitive variables. This suggests that these non-cognitive skills are affecting earnings by helping children achieve more at age 16. The most strongly affected term is the application score; this becomes insignificant. However, the locus of control, clumsiness, anxiety and extrovert scores remain significant predictors of earnings. As we might expect, the importance of the early cognitive variables also diminishes as education variables are introduced.

Specification [5] introduces further educational attainment measures; participation beyond ages 16 and 18, the number of A-levels achieved and whether or not a degree is obtained. When these variables are added, the coefficient for the number of O-levels is reduced by around a half, demonstrating that a large part of the return to O-levels is due to opening up access to these higher levels of education. The return to having a degree is 15% (given the number of O and A-levels achieved). The measures capturing post-16 education make only a marginal further difference to the estimated impact of both the cognitive and non-cognitive scores. This implies that these scores do not predict the likelihood of achieving A-levels or a degree given age 16 attainment.

Column [6] adds measures of labour market attachment. These variables are clearly explaining a significant part of the variation in earnings at age 30, with all coefficients significant and large in magnitude. Just under a quarter of the sample experiences some unemployment and this group spend around 10% (19 months) of the time between leaving full-time education and age 30 in unemployment. These men have on average 12% lower wages when compared to those with no unemployment. It is interesting to note that labour market attachment is not strongly related to the cognitive and non-cognitive variables, given education attainment, as there is little change in the coefficients on these variables when the labour market attachment variables are introduced.

[7] We have experimented with nonlinear functions of the non-cognitive scales but found that using these did not improve the fit of the model.

Table 2 has shown that the cognitive, non-cognitive, education and labour market variables all have significant relationships with parental income. These variables also have an important relationship with earnings, either directly or through education. Table 3 decomposes the overall persistence of income into the contribution of each factor by multiplying each variable's coefficient in the earnings equation by its relationship with family income (from column 1). We summarise this for groups of variables to show the amount of persistence accounted for by the different transmission mechanisms. In addition, the correlation between the residual of the earnings equations and family income is described as the unexplained component.

Specifications [1] and [2] show that the non-cognitive variables can account for 0.06 points of the 0.32 intergenerational coefficient (19%) and the cognitive variables account for 0.09 (27%). When the cognitive and non-cognitive variables are included together in specification [3], the total amount accounted for increases by very little, as we would expect from the earnings regressions.

Table 3

Accounting for the Intergenerational Mobility of Sons Born in 1970

	(1)	(2)	(3)	(4)	(5)	(6)
Anti social 5	0.0074		0.0036	0.0013	0.0008	0.0002
Neurotic 5	0.0000		0.0000	0.0000	0.0000	0.0000
Locus of control 10	0.0177		0.0092	0.0063	0.0062	0.0062
Self esteem 10	0.0044		0.0036	0.0030	0.0023	0.0016
Application 10	0.0262		0.0137	0.0059	0.0051	0.0030
Clumsy 10	0.0053		0.0036	0.0045	0.0050	0.0052
Extrovert 10	0.0028		0.0027	0.0028	0.0029	0.0028
Hyperactive 10	−0.0031		−0.0023	−0.0021	−0.0020	−0.0019
Anxious 10	−0.0011		−0.0007	−0.0004	−0.0004	−0.0002
Anxious 16	0.0026		0.0022	0.0022	0.0025	0.0018
Sum of non-cognitive	*0.0623*		*0.0354*	*0.0234*	*0.0224*	*0.0187*
Epvt 5		0.0088	0.0067	0.0033	0.0038	0.0025
Copy 5		0.0205	0.0175	0.0113	0.0103	0.0091
Reading 10		0.0164	0.0073	0.0011	−0.0009	−0.0002
Maths 10		0.0390	0.0278	0.0137	0.0108	0.0074
British ability scale		0.0089	0.0081	0.0045	0.0026	0.0045
Sum of cognitive		*0.0937*	*0.0675*	*0.0340*	*0.0266*	*0.0233*
No. of O-levels				0.0681	0.0348	0.0297
Sum of education at 16				*0.0681*	*0.0348*	*0.0297*
No. of A-levels					0.0158	0.0182
Staying on post 16					0.0096	0.0069
Degree					0.0379	0.0413
Staying on post 18					−0.0004	0.0037
Sum of post-16 education					*0.0629*	*0.0700*
Time spent unemp						0.0283
Time spent other						0.0020
Sum of labour market attachment						*0.0303*
Explained	*0.0623*	*0.0937*	*0.1029*	*0.1255*	*0.1467*	*0.1720*
Unexplained	*0.2581*	*0.2267*	*0.2175*	*0.1949*	*0.1737*	*0.1484*
Total	*0.3204*	*0.3204*	*0.3204*	*0.3204*	*0.3204*	*0.3204*

Notes. The columns provide the decompositions that are derived from the income and earnings relationships in Table 3, as described in the text. The specifications correspond with the earnings equations in that Table. The contributions of the variables that account for missing values are included in the 'Unexplained' component.

Table 4

Changes in Intergenerational Mobility

	1958 Cohort	1970 Cohort	Change
β	0.205 (.026)	0.291 (.025)	0.086 (.036)
Partial Correlation (r)	0.166 (.021)	0.286 (.025)	0.119 (.033)
Sample Size	2,163	1,976	

Notes. β and r come from a regression of sons' earnings at age 33/30 on parental income at age 16. The difference in the results for the 1970 cohort between Table 4 and 1 comes about because of the different parental income variables used.

The education variables account for a large part of intergenerational persistence, with the introduction of these variables bringing the persistence accounted for to nearly 46%. The introduction of the labour market attachment variables means that over half (54%) of β is accounted for. Non-cognitive and cognitive measures are responsible for just 6% and 7% respectively of the intergenerational persistence given education and labour market attachment. The decline in the importance of these terms as we introduce measures of attainment reflects that the cognitive and non-cognitive scores mostly affect earnings because of their influence on education.

4. Accounting for the Decline in Intergenerational Mobility

4.1. *Estimates of the Change in Intergenerational Mobility*

Table 4 provides estimates of the change in intergenerational mobility for sons between the 1958 and 1970 cohorts. For sons born in 1958, the elasticity of own earnings with respect to parental income at age 16 was 0.205; for sons born in 1970 the elasticity was 0.291. This is a clear and statistically significant growth in the relationship between economic status across generations. For the correlation estimates, the fall in mobility is even more pronounced. The correlation for the 1958 cohort is 0.166 compared with 0.286 for the 1970 cohort. The correlation is lower than the elasticity for the 1958 cohort because of the particularly strong growth in income inequality between when the parental income and sons' earnings data was collected; parental income was collected in 1974 whereas sons' earnings were measured in 1991.

The fall in mobility that we observe is a striking result, and before proceeding to decompose this change, we shall consider its robustness and discuss how our finding fits with the other literature on changes in intergenerational mobility for the UK. The main concern is that the difference in the results between the two cohorts are a consequence of greater downward bias due to measurement error in the NCDS data compared with the BCS. However, there is no reason to suspect that this is the case. Grawe (2004) demonstrates that the income information was not affected by the coincidence of the 1974 survey and the temporary reduction of the working week to three days. Blanden *et al.* (2004) show that realistic assumptions about the extent of measurement error lead to no change in the basic finding that mobility has declined.

Another worry is that the results are being affected by attrition and item non-response. Both cohorts began with around 9,000 sons but attrition and missing infor-

mation on parental income and adult earnings means that only around 2,000 sons are available for each cohort in the comparative analysis. If the losses in sample are purely random then we need not be concerned, however systematic attrition and non-response can lead to biased coefficients, and if it varies, potentially misleading results on changes across the cohorts. Blanden (2005, Appendix) considers the issue of sample selection in the data used here. For the BCS in particular, it appears that the selections made result in a sample that has higher parental status and better child outcomes than the full sample. However, there is no evidence to suggest that this is artificially generating the increase in coefficients across the cohorts.

The results presented in Table 4 are consistent with other estimates using the same data and other UK studies of changes in income mobility. Dearden *et al.* (1997) consider intergenerational earnings persistence for the NCDS cohort and report a higher β of 0.24. A key difference between this result and ours is that they use fathers' earnings rather than parental income. The impact of using parental income rather than father's earnings is explored in Blanden *et al.* (2004) by comparing across cohorts for those families where only the father is in work, this reduces the rise in intergenerational persistence by a small amount, indicating that the changing influence of mothers' earnings or welfare transfers partly explain these differences.

Ermisch and Francesconi (2004) and Ermisch and Nicoletti (2005) have explored the change in intergenerational mobility using the British Household Panel Survey (BHPS). The main difficulty with using the BHPS to measure intergenerational mobility is that data collection only began in 1991. Consequently there are few individuals who are observed in the family home and then as mature members of the labour market. Ermisch and Nicoletti (2005) overcome this problem by using a two-sample two-stage least squares approach to impute father's earnings using sons' recollections of fathers' occupation and education. They find no significant change in mobility between the 1950 and 1972 cohorts, although their findings are consistent with an increase in intergenerational persistence between 1960 and 1971, which would be coincident with the results shown here.

4.2. *Accounting for the Change in Mobility*

As before, the first stage in explaining mobility is to consider the relationships between family income and the mediating variables. These relationships are explored in column 1 of Table 5 for the NCDS and column 1 of Table 6 for the BCS. There are no significant relationships between family income and the non-cognitive scales in the earlier cohort and the relationships between family income and educational attainment are also weaker. Our results also show an increasing negative association between parental income and the amount of time spent in unemployment.[8] The relationships between childhood test scores and parental income are also slightly larger in the second cohort.

The first column of the two tables suggests that the strengthening influence of family income on non-cognitive traits, education and labour market attachment may account for the fall in mobility shown in Table 4. To confirm this we must also look at the

[8] Table 5 shows a small positive association between parental income and time of the labour force for the NCDS cohort. However, this was a very rare labour market state for the men in this cohort.

Table 5

Relationships Between Mediating Variables, Earnings and Family Income, NCDS

		Earnings Regressions			
	Family income relationships	(1)	(2)	(3)	(4)
Non-cognitive 11					
Rutter internalising	−0.026	−0.003	−0.006	−0.008	−0.006
	(0.066)	(0.009)	(0.008)	(0.008)	(0.009)
Rutter externalising	−0.015	−0.008	−0.005	−0.007	−0.002
	(0.070)	(0.008)	(0.009)	(0.009)	(0.008)
Restless	−0.064	−0.008	−0.005	−0.005	−0.004
	(0.062)	(0.012)	(0.012)	(0.012)	(0.012)
Inconsequential	0.016	−0.021	−0.014	−0.014	−0.005
	(0.051)	(0.013)*	(0.013)	(0.013)	(0.012)
Cognitive 11					
Reading	0.290	0.048	0.027	0.016	0.022
	(0.054)***	(0.016)***	(0.017)	(0.017)	(0.016)
Maths	0.360	0.088	0.041	0.036	0.027
	(0.055)***	(0.018)***	(0.018)**	(0.018)**	(0.017)
Verbal and non-verbal ability	0.354	0.035	0.021	0.024	0.020
	(0.053)***	(0.019)*	(0.019)	(0.019)	(0.017)
Education at 16					
English/maths points	1.305		0.036	0.018	0.014
	(0.183)***		(0.004)***	(0.005)***	(0.005)***
Post-16 education					
Number of A-levels	0.313			0.040	0.045
	(0.061)***			(0.015)***	(0.014)***
Stay on post 16	0.203			0.084	0.076
	(0.028)***			(0.027)***	(0.026)***
Degree	0.154			0.106	0.122
	(0.023)***			(0.034)***	(0.033)***
Stay on post 18	0.125			−0.049	−0.028
	(0.022)***			(0.034)	(0.033)
Labour market attachment					
Time unemployed	−0.014				−1.762
	(0.004)***				(0.188)***
Time spent other	0.007				−0.449
	(0.002)***				(0.314)
R-squared		0.12	0.15	0.17	0.25

Notes. See Table 2 for explanation.

relationship with earnings; a fall in the earnings return to these variables could counteract the stronger relationships with incomes. The second columns of the Tables show that the explanatory power of the non-cognitive and cognitive variables on earnings is slightly higher in the NCDS than the BCS, with an R-squared of 0.12 compared with 0.09, (note that the R-squared is markedly lower than for the expanded BCS specification in Table 2). The stronger predictive power of the application and hyperactive BCS variables compared to restless and inconsequential behaviour in the NCDS is more than offset by the greater predictive power of the cognitive test scores in the NCDS. This replicates the results of Galindo-Rueda and Vignoles (2005) who find that ability has declined in its importance in determining children's outcomes.

The education variables reveal a mixed picture, with an increase in the impact on earnings of exams at age 16 and of degree holding, in line with the analysis of the

Table 6

Relationships Between Explanatory Variables, Earnings and Family Income, BCS

		Earnings regressions			
	Family income regressions	(1)	(2)	(3)	(4)
Non-cognitive 10					
Rutter internalising	−0.027	−0.007	−0.013	−0.015	−0.011
	(0.054)	(0.011)	(0.011)	(0.010)	(0.010)
Rutter externalising	−0.297	−0.004	0.001	0.006	0.005
	(0.060)***	(0.008)	(0.008)	(0.008)	(0.008)
Hyperactive	−0.144	0.028	0.030	0.025	0.020
	(0.045)***	(0.012)**	(0.012)**	(0.012)**	(0.011)*
Application	0.291	0.074	0.053	0.046	0.037
	(0.041)***	(0.014)***	(0.014)***	(0.014)***	(0.014)***
Cognitive 10					
Reading	0.468	0.032	0.016	0.004	−0.000
	(0.041)***	(0.017)**	(0.016)	(0.016)	(0.016)
Maths	0.447	0.066	0.034	0.026	0.017
	(0.040)***	(0.017)***	(0.016)**	(0.016)*	(0.016)
British ability scale	0.406	0.029	0.024	0.013	0.016
	(0.047)***	(0.014)**	(0.014)*	(0.013)	(0.013)
Education at 16					
English/maths points	2.096		0.040	0.022	0.022
	(0.153)***		(0.005)***	(0.005)***	(0.005)***
Post-16 education					
Number of A-levels	0.590			0.031	0.035
	(0.062)***			(0.012)**	(0.012)***
Stay on post 16	0.300			0.027	0.020
	(0.021)***			(0.027)	(0.026)
Degree	0.251			0.166	0.172
	(0.020)***			(0.031)***	(0.030)***
Stay on post 18	0.213			0.002	0.020
	(0.0120)***			(0.036)	(0.035)
Labour market attachment					
Time unemployed	−0.027				−1.311
	(0.005)***				(0.144)***
Time spent other	−0.005				−0.255
	(0.0063)				(0.079)***
R-squared		0.09	0.13	0.17	0.22

Notes. See Table 2 for explanation.

returns to education in Machin (2003), but a sharp fall in the return to staying on beyond age 16. There is no change in the influence of labour market attachment on earnings. The impact of the combination of the changes in family income relationships and the change in returns for mobility is not immediately obvious from Tables 5 and 6, and we shall need to turn to the decomposition to show them more clearly.

Table 7 provides a detailed breakdown of the contributions made by the different variables for each cohort. The Table makes it very clear that our mediating variables are doing a good job of accounting for the change in intergenerational mobility. While persistence has increased by 0.086 from 0.205 to 0.291 the part that is accounted for has risen by 0.07 from 0.109 to 0.179: over 80% of the change can be accounted for. Three factors contribute the bulk of the rise in intergenerational mobility: access to higher education (mainly through a strengthening of the relationship with family income),

Table 7

Accounting for the Change in Intergenerational Mobility

NCDS	(1)	(2)	(3)	(4)	BCS	(1)	(2)	(3)	(4)
Rutter internalising	0.0001	0.0002	0.0002	0.0001	Rutter internalising	0.0002	0.0003	0.0004	0.0003
Rutter externalising	0.0001	−0.0001	0.0001	0.0000	Rutter externalising	0.0012	−0.0004	−0.0017	−0.0016
Restless	0.0005	0.0003	0.0003	0.0003	Hyperactive	−0.0040	−0.0043	−0.0036	−0.0029
Inconsequential	−0.0003	−0.0002	−0.0002	−0.0001	Application	0.0215	0.0154	0.0133	0.0107
Sum of non-cognitive at age 11	*0.0004*	*0.0004*	*0.0004*	*0.0003*	*Sum of non-cognitive at age 10*	*0.0188*	*0.0110*	*0.0084*	*0.0066*
Reading	0.0140	0.0078	0.0048	0.0064	Reading	0.0152	0.0074	0.0019	0.0000
Maths	0.0317	0.0148	0.0130	0.0097	Maths	0.0295	0.0151	0.0118	0.0078
Verbal and non-verbal	0.0122	0.0074	0.0085	0.0069	British ability scale	0.0119	0.0096	0.0053	0.0064
Sum of cognitive at age 11	*0.0580*	*0.0300*	*0.0262*	*0.0231*	*Sum of cognitive at age 10*	*0.0566*	*0.0321*	*0.0190*	*0.0141*
English/maths points		0.0469	0.0237	0.0188	English/maths points		0.0847	0.0463	0.0471
Sum of education at 16		*0.0469*	*0.0237*	*0.0188*	*Sum of education at 16*		*0.0847*	*0.0463*	*0.0471*
Number of A-levels			0.0126	0.0140	Number of A-levels			0.0182	0.0205
Stay on post 16			0.0171	0.0155	Stay on post 16			0.0084	0.0061
Degree			0.0163	0.0188	Degree			0.0417	0.0433
Stay on post 18			−0.0061	−0.0036	Stay on post 18			0.0004	0.0043
Sum of post-16 education			*0.0400*	*0.0448*	*Sum of post-16 education*			*0.0686*	*0.0742*
Time unemployed				0.0246	Time unemployed				0.0353
Time spent other				−0.0031	Time spent other				0.0012
Sum of labour market attachment				*0.0215*	*Sum of labour market attachment*				*0.0365*
Explained	*0.0584*	*0.0772*	*0.0904*	*0.1085*	*Explained*	*0.0755*	*0.1278*	*0.1423*	*0.1785*
Unexplained	*0.1469*	*0.1281*	*0.1149*	*0.0968*	*Unexplained*	*0.2152*	*0.1629*	*0.1484*	*0.1122*
Total	*0.2053*	*0.2053*	*0.2053*	*0.2053*	*Total*	*0.2907*	*0.2907*	*0.2907*	*0.2907*

Notes. See Table 3 for explanation.

0.025 or 29%; labour market attachment (entirely through the strength of the relationship with family income), 0.015 or 19%; and attainment at age 16, 0.03 or 34%. Noncognitive traits are also increasingly important (again through the strengthening of the relationship with family background) but they operate mainly through educational attainment. This can be seen by comparing columns [1] and [2] for the two cohorts in Table 7. The role of cognitive ability makes no substantive contribution to changing mobility.

5. Conclusion

This article has explored the role of education, ability, non-cognitive skills and labour market experience in generating intergenerational persistence in the UK. These variables are successful in providing suggestive evidence of how parents with more income produce higher earning sons. The first part of this article shows that they account for half of the association between parental income and children's earnings for the 1970 cohort. It is clear that inequalities in achievements at age 16 and in post-compulsory education by family background are extremely important in determining the level of intergenerational mobility. The dominant role of education disguises an important role for cognitive and noncognitive skills in generating persistence. These variables both work indirectly through influencing the level of education obtained, but are nonetheless important, with the cognitive variables accounting for 20% of intergenerational persistence and non-cognitive variables accounting for 10%. Attachment to the labour market after leaving full-time education is also a substantive driver of intergenerational persistence.

The second aim of the article is to use these variables to understand why mobility has declined between the 1958 and 1970 cohorts. We are able to account for over 80% of the rise in the intergenerational coefficient, with the increased relationship of family income with education and labour market attachment explaining a large part of the change. The growing imbalance in access to higher education by family background as HE expanded has been noted in a number of other papers, (Blanden and Machin, 2004; Glennester, 2002) and here we provide powerful evidence that this imbalance is partly driving the decline in intergenerational mobility in the UK.

Once again though, the role of non-cognitive variables is important. There are clear indications of a strengthening of the relationship between family income and behavioural traits that affect children's educational attainment. However, cognitive ability offers no substantive contribution to changes in mobility; implying that genetically transmitted intelligence is unlikely to be a substantive driver.

If policy makers seek to raise mobility then this research suggests some key areas of intervention, starting with the strengthening relationship between family background and educational attainment. This suggests a need for resources to be directed at programmes to improve the outcomes of those from derived backgrounds. This can be done either by universal interventions that are more effective for poor children, for example high quality pre-school childcare (Currie, 2001) and the UK literacy hour (Machin and McNally, 2004), or by directing resources exclusively at poorer schools or communities. The results above suggest that these

programmes should not be exclusively on cognitive abilities but also towards self-esteem, personal efficacy and concentration. The results also suggest an urgent need to address the problem of youths who are not in education, employment or training (NEETs), owing to the strong link between parental income, early unemployment and future earnings.

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