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BIOSOCIAL CORRELATES OF INTER-GENERATIONAL SOCIAL MOBILITY IN A BRITISH COHORT

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Summary. The relationship between inter-generational social mobility of sons and daughters between 1958 and 1991 and biosocial variables, i.e. birth order, number of children in family, father's social class, region, educational attainment of child and father, educational and cognitive test scores (reading, mathematics, verbal and non-verbal IQ tests), was studied in a large British cohort study. The data used were collected as part of the British National Child Development Study (NCDS). The extent of social class mobility was determined inter-generationally and was categorized as none (no change in social class between the father's and index child's social class), upwardly mobile (where the index child moved up one or more social classes compared with their father) or downwardly mobile (where the index child moved down one or more social classes compared with their father). All of the biosocial variables were associated with social mobility when analysed separately. Multivariate analyses revealed that the most significant predictor of mobility categories in both sexes was education of the cohort member, followed by social class of the father. In both sexes mathematics score was a significant predicator, while in sons reading and non-verbal IQ scores were also important predictors. In the light of these results, it appears that social mobility in Britain takes place largely on meritocratic principles.

Introduction

Social, educational, material, cultural and physical factors in childhood and early adulthood have been shown to be important in determining later success both in the educational system and in the labour market (Mcintosh & Munk, 2009). These variables may also influence the chances and direction of social mobility (Blane *et al.*, 1999). Analyses have been conducted on the relationship between movement in a social hierarchy and a wide variety of biological (Mascie-Taylor, 1984; Lasker & Mascie-Taylor,

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1989; Cernerud, 1995; Hart *et al.*, 1998; Gall *et al.*, 2010; Krzyżanowska & Mascie-Taylor, 2011), social (Breen & Goldthorpe, 1999, 2001; Saunders, 1997, 2002) and economic (Blanden *et al.*, 2006; Andrews & Leigh, 2009) aspects.

A number of social, cultural and economic variables have been identified that associate with movement between social classes, and IQ, educational level as well as childhood social background have all been implicated (Jaeger & Holm, 2003; Nettle, 2003; Richards & Sacker, 2003; Deary *et al.*, 2005; Lampard, 2007; Wolniak *et al.*, 2008; Johnson *et al.*, 2010; von Stumm *et al.*, 2010; Forrest *et al.*, 2011; Sorjonen *et al.*, 2011). In general, the evidence suggests that childhood intelligence, social class of origin and educational qualifications predict status attainment in adulthood. For example, a Danish study found that father's social class was the strongest predictor of educational attainment followed by father's level of education and finally cognitive ability (Jaeger & Holm, 2003). Similar results have been found by Deary *et al.* (2005), whereas Forrest *et al.* (2011) found that childhood IQ and achieved education level were associated with upward mobility. Previous findings on the British National Child Development Study (NCDS) have revealed that individuals from lower class backgrounds have to display more merit than do individuals from higher class backgrounds to reach any given higher class level (Breen & Goldthorpe, 1999, 2001). On the other hand, Saunders (1997, 2002) and Nettle (2003) have suggested an individual's economic success and life opportunities more generally are determined by their own ability and effort.

Although status attainment strongly depends on education, intelligence and social class of origin, these variables only account for 35–40% of the variance in status attainment (Hauser *et al.*, 1996; von Stumm *et al.*, 2010). Therefore many researchers have considered a number of additional variables. For example, Hauser *et al.* (1996) explored family structure and number of siblings, the respondent's perception of encouragement and their aspirations, whereas Biblarz *et al.* (1997) focused on different types of family structure experienced during childhood. Deary *et al.* (2005) and Forrest *et al.* (2011) examined height in adulthood as one of the potential predictors of status attainment. Bond & Saunders (1999) and Schoon (2008) analysed academic aspirations and school motivation, while DiRago & Vaillant (2007) pointed out timely childhood development. The effects of self-esteem, locus of control and childhood behaviour disturbance were also considered by von Stumm *et al.* (2009, 2010).

However, very few studies have analysed the influence of social background, ability and other psychological variables on occupational status in adulthood simultaneously (Hauser *et al.*, 1996; Jaeger & Holm, 2003; Deary *et al.*, 2005; Forrest *et al.*, 2011).

The present study examined the relationship between inter-generational social mobility of sons and daughters between 1958 and 1991 in relation to the following biological variables (sex, birth order) and social variables (number of children in family, father's social class, region, educational attainment of child and father, educational and cognitive test scores: reading, mathematics, verbal and non-verbal IQ tests) in a large British national cohort study.

Methods

The data used in these analyses were collected as part of the National Child Development Study (NCDS). The NCDS is a longitudinal (panel) study of all children born in

England, Wales and Scotland in the week 3–9th March 1958. Subsequently the children and their families were followed up periodically in 1965, 1969 and 1974. Thereafter just the index child was followed into adulthood and there were re-studies in 1991 and 2000 (at ages 33 and 42, respectively). A total of 2169 boys and 2304 girls for whom there were complete data from birth to 33 years of age were studied. The few children from ethnic minorities were excluded from the analyses. Attrition was due to common causes (refusal, moving or death) and refusal rates were relatively low, so the cohort remained broadly representative in terms of biological, social and health characteristics from childhood to adulthood (Power & Elliott, 2006; Atherton *et al.*, 2008).

Information on a number of biosocial variables was studied. Birth order was categorized as first, second and third born and above. Father's social class in 1958 was defined using the Registrar General's classification where I refers to professional, II to intermediate (mainly managerial), III skilled worker, IV semi-skilled worker and V unskilled. The extent of social class mobility was determined inter-generationally between father and child (son or daughter). Inter-generational social mobility between 1958 and 1991 was categorized as none (no change in social class between the father's and index child's social class), upwardly mobile (where the index child moved up one or more social classes compared with their father) or downwardly mobile (where the index child moved down one or more social classes compared with their father). Because sons born in social class I can only be non-mobile or downwardly mobile and those sons born in social class V can only be non-mobile or upwardly mobile, the analyses were restricted to father's social classes II to IV. Families were placed into one of the nine standard regions comprising North, Yorkshire and Humberside, East Midlands, East and South East, South West, West Midlands, North West, Wales and Scotland (see Fig. 1).

Education of the index child as well as father's educational level were classified as: 1, university; 2, A level(s); 3, O level(s); 4, apprenticeship or no qualifications. The reading, mathematics and verbal and non-verbal IQ test scores of the index child at age 11 were also analysed. Family size was analysed as a continuous variable and because of right skew was normalized using a logarithmic (base 10) transformation.

The ten variables did not show significant multicollinearity as defined by a correlation of above 0.90 (Tabachnick & Fidell, 2006).

Results

Relationship between biosocial variables and inter-generational social mobility

Table 1 presents the extent of inter-generational social mobility of sons and daughters in relation to five categorical biosocial variables. Birth order and social mobility were just significantly associated but only for sons ($\chi^2_{(4)} = 11.28$, $p = 0.024$). The main finding was that first-born sons were more likely to be socially non-mobile or upwardly mobile than expected while second- or later-born sons were more likely to be downwardly socially mobile (Table 1).

There was a significant relationship between father's social class and inter-generational social mobility of sons ($\chi^2_{(8)} = 421.31$, $p < 0.001$) and daughters ($\chi^2_{(8)} = 364.02$, $p < 0.001$) (Table 1). Children from social classes III and IV were more likely to be

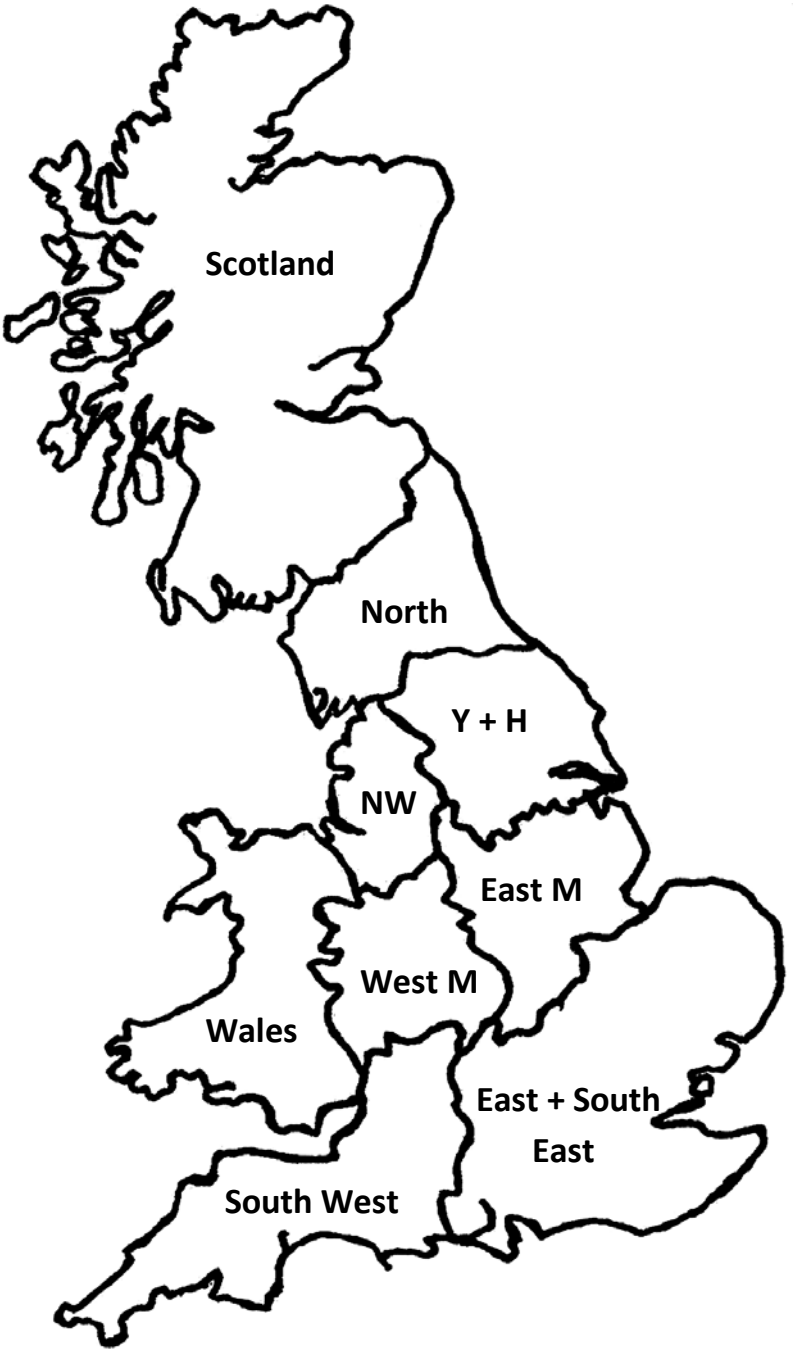

Fig. 1. Map of Britain showing the nine study regions (Y + H = Yorkshire + Humberside; East M = East Midlands; West M = West Midlands; NW = North West).

Table 1. Relationship between categorical variables and inter-generational social mobility (row percentages are presented)

	Sons					Daughters				
	Social mobility (%)					Social mobility (%)				
Variable	Down	None	Up	χ^2	p	Down	None	Up	χ^2	p
Birth order										
1	13.3	45.0	41.7	11.28	0.024	25.3	40.8	33.9	2.20	ns
2	17.6	44.7	37.7			24.1	42.7	33.2		
3+	18.5	45.9	35.6			27.1	41.2	31.7		
Father's social class										
II	39.4	47.3	13.3	421.31	<0.001	52.6	38.8	8.6	364.02	<0.001
III	13.6	50.1	36.3			23.3	44.9	31.8		
IV	1.7	16.4	81.9			5.0	27.7	67.3		
Education of cohort member										
(1) University	7.2	26.7	66.1	246.14	<0.001	10.0	25.6	64.4	311.04	<0.001
(2) A levels	13.7	47.1	39.2			22.0	40.2	37.8		
(3) O levels	14.5	53.2	32.3			25.0	49.0	26.0		
(4) No qualifications	29.1	48.5	22.4			38.0	42.5	19.5		
Education of father										
(1) University	20.2	49.5	30.3	14.52	0.024	28.3	37.9	33.8	5.75	ns
(2) A levels	17.4	37.8	44.8			29.3	37.5	33.2		
(3) O levels	13.6	45.0	41.4			25.7	41.6	32.7		
(4) No qualifications	16.4	46.5	37.1			24.2	42.8	33.0		
Region										
North	17.8	46.1	36.1	15.59	ns	28.2	44.8	27.0	12.65	ns
Yorkshire + Humberside	17.1	44.5	38.4			25.3	41.6	33.1		
East Midlands	11.0	48.8	40.2			29.8	38.0	32.2		
East + South East	16.9	44.3	38.8			24.5	42.6	32.9		
South West	16.9	48.1	35.0			28.6	38.8	32.6		
West Midlands	14.9	50.5	34.6			26.4	41.7	31.9		
North West	19.0	42.1	38.9			25.0	41.8	33.2		
Wales	12.0	48.9	39.1			25.9	42.6	31.5		
Scotland	16.9	38.5	44.6			21.1	39.1	39.8		

upwardly socially mobile than expected and those from social class II were much more likely to be downwardly socially mobile than expected (Table 1).

The results for education of the cohort members (whether sons or daughters) indicated that there was a very significant association between their educational attainment and inter-generational social mobility ($\chi^2_{(6)} = 246.14$, $p < 0.001$ for sons and $\chi^2_{(6)} = 311.04$, $p < 0.001$ for daughters). It appeared that those with higher educational qualifications (university and A levels, categories 1 and 2) were much more upwardly socially mobile than expected while children with a medium level of education and without qualifications (O levels and no qualifications, categories 3 and 4) were more likely to be non-socially mobile or downwardly mobile than expected (Table 1).

There were significant relationships between father's education and inter-generational social mobility of sons ($\chi^2_{(6)} = 14.52$, $p = 0.024$). Those whose fathers attained the lowest level of education were more likely to be non-socially mobile (29.0%) or upwardly mobile (23.2%) than downwardly mobile. Furthermore, sons whose fathers achieved higher educational level were much more downwardly mobile than expected (Table 1).

No regional differences were found in inter-generational social mobility ($\chi^2_{(16)} = 15.59$, $p = 0.482$ for sons and $\chi^2_{(16)} = 12.65$, $p = 0.698$ for daughters) (Table 1).

There was a significant relationship between the number of children in the family and inter-generational social mobility of the cohort members ($F = 4.69$, $p = 0.009$ for sons and $F = 5.14$, $p = 0.006$ for daughters) (Table 2). Upwardly socially mobile or non-mobile children came from families with smaller numbers of children, while children with higher number of siblings were much more likely to be downwardly mobile. The analyses of the cognitive tests revealed strong associations with social mobility, more so for sons than daughters (Table 2). There was a general tendency for mean scores to increase from downwardly socially mobile to upwardly mobile. *Post hoc* tests revealed that the main differences were between the upwardly mobile versus the non- and downwardly mobile; for example, for reading score, the upwardly mobile mean was 2.31 and 3.30 above the non- and downwardly mobile means, whereas the difference between the non-mobile and downwardly mobile means was only 0.99.

Multinomial logistic regression analyses

In order to test which of the biosocial variables contributed to explaining inter-generational social mobility, a series of multinomial logistic regression analyses were undertaken for sons and daughters separately. In the first analysis all ten socio-economic and cognitive variables were included in the model. It appeared that for both sons and daughters their education and social class of their father, as well as non-verbal IQ and reading and mathematics scores for sons, were the most important variables. Overall, just over 60% of the three mobility categories were predicted for both sons and daughters, and there was better prediction of the non-mobile, followed by the upwardly and downwardly mobile groups.

In the second analysis a stepwise multinomial logistic regression procedure was used in which the most significant predictor entered the model first followed by the second most significant predictor, and so on. The results (Table 3) revealed that for both sons and daughters the most significant predictor of mobility categories was

Table 2. Relationship between continuous variables and inter-generational social mobility

	Sons								Daughters							
	Social mobility								Social mobility							
	Down		None		Up				Down		None		Up			
Variable	Mean	SD	Mean	SD	Mean	SD	*F*	*p*	Mean	SD	Mean	SD	Mean	SD	*F*	*p*
Number of children	3.08	1.23	2.99	1.19	2.87	1.13	4.69	0.009	3.05	1.24	2.90	1.17	2.85	1.15	5.14	0.006
Verbal IQ	19.92	8.94	21.73	8.73	24.87	8.51	50.44	<0.001	22.98	8.85	24.53	7.95	26.75	7.68	37.22	<0.001
Non-verbal IQ	19.62	7.13	21.28	6.89	23.89	6.81	57.58	<0.001	21.14	7.19	22.11	6.74	23.78	6.50	26.69	<0.001
Reading score	15.24	5.92	16.23	5.74	18.54	5.86	53.93	<0.001	15.77	5.69	16.70	5.30	18.26	5.33	37.24	<0.001
Mathematics score	14.96	9.82	17.29	9.60	21.20	9.71	63.65	<0.001	16.10	9.74	17.62	9.28	20.81	9.56	44.97	<0.001

Table 3. Results of multinomial regression analyses to predict inter-generational social mobility

Reduced model		Sons				Daughters			
				OR				OR	
		χ^2	p	Down	Up	χ^2	p	Down	Up
Step 1	Education of cohort member								
	(1) University	457.683	<0.001	0.260	8.331	666.844	< 0.001	0.148	18.347
	(2) A levels			0.409	1.989			0.414	2.748
	(3) O levels			0.430	1.422			0.492	1.354
	(4) No qualifications			1	1			1	1
Step 2	Father's social class								
	II	414.513	<0.001	23.063	0.009	368.720	< 0.001	20.800	0.008
	III			3.996	0.068			3.760	0.142
	IV			1	1			1	1
Step 3	Mathematics score	77.985	<0.001	–	–	26.990	< 0.001	–	–
Step 4	Reading score	19.903	<0.001	–	–	–	–	–	–
Step 5	Non-verbal IQ	12.721	0.002	–	–	–	–	–	–

63.3% of boys and 62.2% of girls were correctly classified (boys: downwardly mobile 17.9%; non-mobile 80.9%; upwardly mobile 61.9%; girls: 34.9%; 77.4%; 64.0%, respectively).

education of the cohort member, followed by social class of the father and then mathematics score. Only in sons were reading and non-verbal IQ scores significant predictors. With this reduced model the percentage correctly predicted fell slightly in both sons and daughters with the non-mobile group being best predicted.

Better-educated cohort members were more likely to be upwardly mobile than the non-qualified (1.4 to 8.3 times for sons and 1.4 to 18.4 times for daughters). Sons and daughters of fathers from higher social classes were 4.0 to 23.1 for sons and 3.8 to 20.8 for daughters times more likely to be downwardly mobile than children of fathers from lower social classes (Table 3).

Discussion

This paper examines the relationship between inter-generational social mobility (between father's social class and cohort member's own social class in adulthood) and selected variables in a British cohort study (NCDS). Among the biosocial variables analysed separately almost all of them (birth order, sibship size in the families, father's social class and his education, educational attainment of the cohort members and the results of their cognitive tests, i.e. reading, mathematics and verbal and non-verbal IQ tests) were associated with cohort member's social class.

Birth order has been considered one of the most influential environmental factors in child development (Berger & Felsenthal-Berger, 2009). First-borns tend to be larger and stronger, and have better health outcomes and socioeconomic environment than later-born siblings (Barreto & Rodrigues, 1992; Elliott, 1992; Kaplan et al., 1992; Li & Taylor, 1993; Lewis & Britton, 1998; Modin, 2002; Argys et al., 2006). A number of studies have found that first-borns had an academic advantage over later-borns (Zajonc & Markus, 1975; Zajonc, 1976; Cherian, 1990; Sulloway, 1996; Kantarevic & Mechoulan, 2005; Fergusson *et al.*, 2006; de Haan, 2010) and higher IQ scores (Paulhus *et al.*, 1999; Bjerkedal *et al.*, 2007; Boomsma *et al.*, 2008; Black *et al.*, 2011), but other studies have failed to confirm this finding (Steelman & Powell, 1985; Ha & Tam, 2011). A significant positive relationship between birth order and social skills, such as outgoingness, getting along with others, popularity, ease in making friends, has also been found (Steelman & Powell, 1985).

According to Sulloway (1996) children have an innate tendency to develop the attitudes and personalities best suited for maximizing the parental resources that they get. They compete for parental investment (time, energy and material resources) by creating distinctive niches. It has been hypothesized (Sulloway, 1996) that first-borns are less agreeable as compared with later-born children because first-borns occupy a dominant position in a sibling group and develop more conservative attitudes (dependent, serious, more sensitive to parents' expectations) than their younger siblings. First-borns have been found to be more extravert, self-confident, assertive and aggressive than later-borns (Sulloway, 1996; Paulhus *et al.*, 1999; Rohde *et al.*, 2003). They are subjected to more accelerated role playing and training, and are more responsible, well-organized, supportive of authority, 'tough-minded' and patient in real-life decisions. Consequently, early-born children tend to be more ambitious, achievement- and success-oriented as well as motivated to attain a high social position and eminence

than their later-born counterparts (Sulloway, 1996; Rohde *et al.*, 2003; Healey & Ellis, 2007).

The findings from this study revealed that first-born sons were more likely to be socially upwardly mobile or non-mobile, while later-born sons were more likely to be downwardly socially mobile. However, in the multivariate analyses the birth order effect was not significant.

An inverse and consistent relationship between the number of siblings and health, as well as educational outcomes, has been widely reported. For example it has been found that people who have more siblings, on average, have grown up in more overcrowded accommodation, with greater exposure to early infections, and with access to a less than adequate diet (Blane *et al.*, 1999). Consequently, a greater number of siblings is strongly related to early childhood morbidity and mortality risk (Hart & Davey Smith, 2003). Furthermore, smaller sibships are more likely to produce higher achieving and more intelligent children than larger families (Falbo & Polit, 1986; Blake, 1989; Downey, 1995; Iacovou, 2001; Bradley & Taylor, 2004; Parr, 2006; Li *et al.*, 2008; Booth & Kee, 2009; Jaeger, 2009; Sen & Clemente, 2010).

Children who come from smaller families have a better chance of being upwardly mobile compared with children from larger families. A negative relation between upward mobility and family size was found by Tomasson (1966) in a sample of 583 couples from Peoria, Springfield and Rockford, Illinois. Marjoribanks (1987), using longitudinal data from 310 Australians, found that sibsize was not related to the social mobility of males, but that it did influence the eventual social status of females. Decreased chance of upward mobility with increasing number of siblings has been reported by Blane *et al.* (1999) in a cohort of 5645 employed men from the West of Scotland Collaborative study. Van Bavel *et al.* (2011) investigated the association between family size and inter-generational mobility in the city of Antwerp between 1846 and 1920 and found, after controlling for confounding factors, that people with many children were more likely to end up in the lower classes.

In the current study children from families with smaller numbers of sibs were more likely to be socially non-mobile or upwardly mobile. However, similarly to birth order, the sibling size effect became non-significant in the multivariate analyses.

The role of social origin (parental social class in childhood) in health outcomes, educational attainment and social class in adulthood has been reported very often (Shavit & Blossfeld, 1993; Davey Smith *et al.*, 1998; Bosma *et al.*, 1999; Breen & Jonsson, 2000; Breen & Goldthorpe, 2001; Jaeger & Holm, 2003; Iannelli & Paterson, 2005; von Stumm *et al.*, 2009). However, there is a debate among social scientists as to whether an individual's economic success and life opportunities more generally are determined by their own ability and effort (Saunders, 1997, 2002) or by their parents' socioeconomic status (Breen & Jonsson, 2000; Breen & Goldthorpe, 1999, 2001). Breen and Goldthorpe (1999, 2001), using the NCDS data, found a substantial effect of class of origin on social class at age 33, and that education substantially mediated these effects. They pointed out that individuals from lower class backgrounds have to display more merit than do individuals from higher class backgrounds to reach any given higher class level. Carneiro's *et al.* (2007) results based on the same material showed that children from both professional and non-manual family backgrounds exhibit significantly greater cognitive and non-cognitive skills than children from manual backgrounds. Jaeger &

Holm (2003), using data from the Danish Youth Longitudinal Panel Survey, found father's social class to be the strongest predictor of educational attainment, followed by father's level of education and finally cognitive ability. It has been demonstrated on the data from the 2001 Scottish Household Survey, that education plays an intermediary role between class of origin and class of destination, i.e. there is still a strong direct effect of social class of origin on people's class of destination – even after taking educational attainment into account (Iannelli & Paterson, 2005). Deary *et al.* (2005) suggested that the correlation between childhood IQ and own social class at mid-life is stronger than the correlation with father's social class. Furthermore, the association between parental social class and class of destination is weaker for more highly educated people than for less educated people. A study using conscription data and follow-ups on 36,156 Swedish men born between 1949 and 1951 found that when adjusting for attained social position, people with a high social position of origin tend to have higher intelligence and level of education than people with a lower social position of origin (Sorjonen *et al.*, 2011).

The current study also found a significant relationship between father's social class and inter-generational social mobility of the cohort members. Children from social classes III and IV were more likely to be upwardly socially mobile than expected and those from social class II were much more likely to be downwardly socially mobile. In the multivariate analysis it appeared that for both sons and daughters the most significant predictor of mobility categories was education of children, followed by social class of the father.

Education has been described as 'a vehicle for professionalization' and associated with social mobility (Müller & Shavit, 1998; Nettle, 2003; Cardano *et al.*, 2004; Machin, 2004; Deary *et al.*, 2005; Iannelli & Paterson, 2005), measured either as number of years of education, level of education or IQ. In educational attainment studies, parents' educational characteristics have not been a central concern, often being viewed as one aspect of the concept of 'family background' (Sieben & De Graaf, 2001). Parental education correlates with several other factors such as income, occupation, culture and social resources that matter in a life-cycle perspective. Lampard's (2007) examination of the direct and indirect effects of parents' education and social classes on children's occupational attainment in a British Household Panel Survey (BHPS) has shown that parental education plays a substantial role in the inter-generational transmission of advantage, and has indicated that part (but not all) of the relationship between class origin and occupational attainment can be explained in terms of the inter-generational transmission of cultural capital. Data from the Columbia County Longitudinal Study have revealed a strong relationship between parents' educational level and children's occupation. Parents' educational level when the child was 8 years old significantly predicted educational and occupational success for the child 40 years later (Dubow *et al.*, 2009).

Black *et al.* (2007) pointed out that IQ is a strong predictor of educational attainment and future labour market success. Studies of intelligence and class mobility have demonstrated that men who are upwardly mobile in socioeconomic terms tend to have higher IQ scores than their fathers, whilst those who are downwardly mobile tend to have lower scores (Waller, 1971; Mascie-Taylor & Gibson, 1978). In the current study, higher IQ (whether sons or daughters) was associated with upward mobility in the univariate analyses and was significant for mathematics score among sons and daughters

in the multivariate analyses. Reading score and non-verbal IQ were significant only among sons. Using the same NCDS data, Saunders (2002) found that class of origin accounted for about 25% of the explained variance in class at age 33, whereas ability, motivation and qualifications accounted for over 60%. As has been reported by Nettle (2003), attained social class in adulthood was more strongly related to GA score (the General Ability test) than parental social class. Similar results were reported by Deary *et al*. (2005) among men who participated in the Scottish Mental Survey of 1932 and thereafter in the Midspan Collaborative study in Scotland between 1970 and 1973. It appeared that height at mid-life, years of education and childhood IQ were significantly positively related to upward social mobility. Controlling for the effects of the individual independent variables reduced the effects, with only height and education remaining significant; childhood IQ was of borderline significance. In a birth cohort of 6281 men from Aberdeen, Scotland, von Stumm *et al.* (2010) confirmed that education had the strongest direct effect on status attainment at mid-life. The results of the present study are also in agreement with other British data analysed by Forrest *et al*. (2011). For the Newcastle Thousand Families 1947 birth cohort childhood IQ and achieved education level were both significantly and positively related to upward intergenerational mobility at the univariate level. However, only childhood IQ was significantly associated with upward mobility between 25 and 49–51 years, whereas only education level was significantly associated with upward mobility between 5 and 25 years, which means that IQ level is more strongly connected with social class attained in middle-age rather than early adulthood (Forrest *et al*., 2011).

The present data clearly show that for both sons and daughters the most significant predictor of inter-generational social mobility was their own educational level. Children (whether sons or daughters) from social classes III and IV with higher educational qualifications (having a degree or above; teaching or nursing qualification; passed A levels) were more likely to be upwardly socially mobile or non-mobile. In the light of these results, there is agreement with Saunders' (1997, 2002) point of view that social mobility in Britain takes place largely on meritocratic principles.

References

Andrews, D. & Leigh, A. (2009) More inequality, less social mobility. *Applied Economics Letters* **16**, 1489–1492.

Argys, L. M., Rees, D. I., Averett, S. L. & Witoonchart, B. (2006) Birth order and risky adolescent behavior. *Economic Inquiry* **44**, 215–233.

Atherton, K., Fuller, E., Shepherd, P., Strachan, D. P. & Power, C. (2008) Loss and representativeness in a biomedical survey at age 45 years: 1958 British birth cohort. *Journal of Epidemiology and Community Health* **62**, 216–223.

Barreto, T. V. & Rodrigues, L. C. (1992) Factors influencing childhood immunization in an urban area of Brazil. *Journal of Epidemiology and Community Health* **46**, 357–361.

Berger, I. & Felsenthal-Berger, N. (2009) Attention-deficit hyperactivity disorder (ADHD) and birth order. *Journal of Child Neurology* **24**(6), 692–696.

Biblarz, T. J., Raftery, A. E. & Bucur, A. (1997) Family structure and social mobility. *Social Forces* **75**(4), 1319–1341.

Bjerkedal, T., Kristensen, P., Skjeret, G. A. & Brevik, J. I. (2007) Intelligence test scores and birth order among young Norwegian men (conscripts) analyzed within and between families. *Intelligence* **35**, 503–514.

Black, S. E., Devereux, P. J. & Salvanes, K. G. (2007) Small family, smart family? Family size and the IQ scores of young men. *National Bureau of Economic Research*, Working Paper No. 13336, pp. 1–38.

Black, S. E., Devereux, P. J. & Salvanes, K. G. (2011) Older and wiser? Birth order and IQ of young men. *CESifo Economic Studies* **57**(1), 103–120.

Blake, J. (1989) *Family Size and Achievement*. University of California Press, Berkeley.

Blanden, J., Gregg, P. & Macmillan, L. (2006) Explaining intergenerational income persistence: non-cognitive skills, ability and education. *CMPO Working Paper Series*, No. 06/146.

Blane, D., Davey Smith, G. & Hart, C. (1999) Some social and physical correlates of intergenerational social mobility: evidence from the West of Scotland Collaborative Study. *Sociology* **33**, 169–183.

Bond, R. & Saunders, P. (1999) Routes of success: influences on the occupational attainment of young British males. *British Journal of Sociology* **50**, 217–249.

Boomsma, D. I., van Beijsterveld, T. C. E. M., Beem, A. L., Hoekstra, R. A., Polderman, T. J. C. & Bartels, M. (2008) Intelligence and birth order in boys and girls. *Intelligence* **36**, 630–634.

Booth, A. & Kee, H. J. (2009) Birth order matters: the effect of family size and birth order on educational attainment. *Journal of Population Economics* **22**, 367–397.

Bosma, H., van de Mheen, H. D. & Mackenbach, J. P. (1999) Social class in childhood and general health in adulthood: questionnaire study of contribution of psychological attributes. *British Medical Journal* **318**, 18–22.

Bradley, S. & Taylor, J. (2004) Ethnicity, educational attainment and the transition from school. *The Manchester School* **72**, 317–346.

Breen, R. & Goldthorpe, J. H. (1999) Class inequality and meritocracy: a critique of Saunders and an alternative analysis. *British Journal of Sociology* **50**, 1–27.

Breen, R. & Goldthorpe, J. H. (2001) Class, mobility and merit: the experience of two British birth cohorts. *European Sociological Review* **17**, 81–101.

Breen, R. & Jonsson, J. O. (2000) Analyzing educational careers: a multinomial transition model. *American Sociological Review* **65**, 754–772.

Cardano, M., Costa, G. & Demaria, M. (2004) Social mobility and health in the Turin longitudinal study. *Social Science & Medicine* **58**, 1563–1574.

Carneiro, P., Crawford, C. & Goodman, A. (2007) The impact of early cognitive and non-cognitive skills on later outcomes. *Centre for the Economics of Education*, LSE, London.

Cernerud, L. (1995) Height and social mobility. A study of the height of 10 year olds in relation to socio-economic background and type of formal schooling. *Scandinavian Journal of Social Medicine* **23**, 28–31.

Cherian, V. I. (1990) Birth order and academic achievement of children in Transkei. *Psychological Reports* **66**, 19–24.

Davey Smith, G., Hart, C., Hole, D., MacKinnon, P., Gillis, C. & Watt, G. C. (1998) Education and occupational social class: which is the more important indicator of mortality risk? *Journal of Epidemiology and Community Health* **52**, 153–160.

Deary, I., Taylor, M., Hart, C., Wilson, V., Smith, G., Blane, D. & Starr, J. (2005) Intergenerational social mobility and mid-life status attainment: influences of childhood intelligence, childhood social factors, and education. *Intelligence* **33**, 455–472.

de Haan, M. (2010) Birth order, family size and educational attainment. *Economics of Education Review* **29**, 576–588.

DiRago, A. C. & Vaillant, G. E. (2007) Resilience in inner city youth: childhood predictors of occupational status across the lifespan. *Journal of Youth and Adolescence* **36**, 61–70.

Downey, D. B. (1995) When bigger is not better: family size, parental resources, and children's educational performance. *American Sociological Review* **60**, 746–761.

Dubow, E. F., Boxer, P. & Huesmann, L. R. (2009) Long-term effects of parents' education on children's educational and occupational success: mediation by family interactions, child aggression, and teenage aspirations. *Merrill-Palmer Quarterly* **55**(3), 224–249.

Elliott, B. A. (1992) Birth order and health: major issues. *Social Science & Medicine* **35**(4), 443–452.

Falbo, T. & Polit, D. F. (1986) A quantitative review of the only child literature: research evidence and theory development. *Psychological Bulletin* **100**, 176–189.

Fergusson, D. M., Horwood, L. J. & Boden, J. M. (2006) Birth order and educational achievement in adolescence and young adulthood. *Australian Journal of Education* **50**, 122–139.

Forrest, L. F., Hodgson, S., Parker, L. & Pearce, M. S. (2011) The influence of childhood IQ and education on social mobility in the Newcastle Thousand Families birth cohort. *BMC Public Health* **11**, 895.

Gall, S. L., Abbott-Chapman, J., Patton, G. C., Dwyer, T. & Venn, A. (2010) Intergenerational educational mobility is associated with cardiovascular disease risk behaviours in a cohort of young Australian adults: the Childhood Determinants of Adult Health (CDAH) Study. *BMC Public Health* **10**, 55.

Ha, T. S. & Tam, C. L. (2011) A study of birth order, academic performance, and personality. *International Conference on Social Science and Humanity*, IPEDR, Vol. 5, IACSIT Press, Singapore.

Hart, C. L. & Davey Smith, G. (2003) Relation between number of siblings and adult mortality and stroke risk: 25 year follow up of men in the Collaborative Study. *Journal of Epidemiology and Community Health* **57**, 385–391.

Hart, C. L., Davey Smith, G. & Blane, D. (1998) Social mobility and 21 year mortality in a cohort of Scottish men. *Social Science & Medicine* **47**, 1121–1130.

Hauser, R. M., Warren, J. R., Huang, M-H. & Carter, W. Y. (1996) Occupational status, education, and social mobility in the meritocracy. *Center for Demography and Ecology (CDE)*, Working Paper No. 96–18.

Healey, M. D. & Ellis, B. J. (2007) Birth order, conscientiousness, and openness to experience: tests of the family-niche model of personality using a within-family methodology. *Evolution and Human Behavior* **28**, 55–59.

Iacovou, M. (2001) Family composition and children's educational outcomes. Working Paper of *Institute for Social and Economic Research*, University of Essex, Colchester. URL: http://www.iser.essex.ac.uk/pubs/workpaps/pdf/2001-12.pdf (accessed 29th April 2009).

Iannelli, C. & Paterson, L. (2005) Does education promote social mobility? *Centre for Educational Sociology*, CES Briefing No. 35, University of Edinburgh.

Jaeger, M. M. (2009) Sibship size and educational attainment: a joint test of the confluence model and the resource dilution hypothesis. *Research in Social Stratification and Mobility* **27**, 1–12.

Jaeger, M. M. & Holm, A. (2003) Which background factors matter more in intergenerational educational attainment: social class, cultural capital or cognitive ability? A random effects approach. *Centre for Applied Microeconometrics* 1–28.

Johnson, W., Brett, C. E. & Deary, I. J. (2010) The pivotal role of education in the association between ability and social class attainment: a look across three generations. *Intelligence* **38**, 55–65.

Kantarevic, J. & Mechoulan, S. (2005) Birth order, educational attainment and earnings: an investigation using the PSID. *IZA Discussion Papers*, No. 1789. URL: http://hdl.handle.net/10419/33423.

Kaplan, B. A., Mascie-Taylor, C. G. N. & Boldsen, J. (1992) Birth order and health status in a British national sample. *Journal of Biosocial Science* **24**(1), 25–34.

Krzyżanowska, M. & Mascie-Taylor, C. G. N. (2011) Intra- and intergenerational social mobility in relation to height, weight and body mass index in a British national cohort. *Journal of Biosocial Science* **43**, 611–618.

Lampard, R. (2007) Is social mobility an echo of educational mobility? Parents' educations and occupations and their children's occupational attainment. *Sociological Research Online* **12**, 16.

Lasker, G. W. & Mascie-Taylor, C. G. N. (1989) Effects of social class differences and social mobility on growth in height, weight and body mass index in a British cohort. *Annals of Human Biology* **16**, 1–8.

Lewis, S. A. & Britton, J. R. (1998) Measles infection, measles vaccination and the effect of birth order in the aetiology of hay fever. *Clinical and Experimental Allergy* **28**, 1493–1500.

Li, J. & Taylor, B. (1993) Factors affecting uptake of measles, mumps, and rubella immunization. *British Medical Journal* **307**, 168–171.

Li, H., Zhang, J. & Zhu, Y. (2008) The quantity-quality trade-off of children in a developing country: identification using Chinese twins. *Demography* **45**, 223–243.

Machin, S. (2004) Education systems and intergenerational mobility 1. *Education* 1–26.

Marjoribanks, K. (1987) Birth order and sibsize correlates of educational attainment and occupational status. *Psychological Reports* **61**, 147–150.

Mascie-Taylor, C. G. N. (1984) The interaction between geographical and social mobility. In Boyce, A. J. (ed.) *Migration & Mobility, Biosocial Aspects of Human Movement*. Symposia of the Society for the Study of Human Biology, Vol. 23. Taylor & Francis, London and Philadelphia, pp. 161–178.

Mascie-Taylor, C. G. N. & Gibson, J. B. (1978) Social mobility and IQ components. *Journal of Biosocial Science* **10**, 263–276.

Mcintosh, J. & Munk, M. (2009) Social class, family background, and intergenerational mobility. *European Economic Review* **53**, 107–117.

Modin, B. (2002) Birth order and mortality: a life-long follow-up of 14,200 boys and girls born in early 20th century Sweden. *Social Science & Medicine* **54**, 1051–1064.

Müller, W. & Shavit, Y. (1998) The institutional embeddedness of the stratification process: a comparative study of qualifications and occupations in thirteen countries. In Shavit, Y. & Müller, W. (eds) *From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations*. Clarendon Press, New York, pp. 1–48.

Nettle, D. (2003) Intelligence and class mobility in the British population. *British Journal of Psychology* **94**, 551–561.

Parr, N. (2006) Do children from small families do better? *Journal of Population Research* **23**, 1–25.

Paulhus, D. L., Trapnell, P. D. & Chen, D. (1999) Birth order effects on personality and achievement within families. *Psychological Science* **10**, 482–488.

Power, C. & Elliott, J. (2006) Cohort profile: 1958 British birth cohort (National Child Development Study). *International Journal of Epidemiology* **35**, 34–41.

Richards, M. & Sacker, A. (2003) Lifetime antecedents of cognitive reserve. *Journal of Clinical and Experimental Neuropsychology* **25**, 614–624.

Rohde, P. A., Atzwanger, K., Butovskaya, M., Lampert, A., Mysterud, L., Sanchez-Andres, A. & Sulloway, F. J. (2003) Perceived parental favoritism, closeness to kin, and the rebel of the family. *Evolution and Human Behavior* **24**, 261–276.

Saunders, P. (1997) Social mobility in Britain: an empirical evaluation of two competing explanations. *Sociology* **31**, 261–288.

Saunders, P. (2002) Reflections on the meritocracy debate in Britain: a response to Richard Breen and John Goldthorpe. *British Journal of Sociology* **53**, 559–574.

Schoon, I. (2008) A transgenerational model of status attainment: the potential mediating role of school motivation and education. *National Institute Economic Review* **205**(1), 72–82.

Sen, A. & Clemente, A. (2010) Intergenerational correlations in educational attainment: birth order and family size effects using Canadian data. *Economics of Education Review* **29**, 147–155.

Shavit, Y. & Blossfeld, H. P. (eds) (1993) *Persistent Inequalities: A Comparative Study of Educational Attainment in Thirteen Countries.* Westview Press, Boulder, Colorado.

Sieben, I. & De Graaf, P. M. (2001) Testing the modernization hypothesis and the socialist ideology hypothesis: a comparative sibling analysis of educational attainment and occupational status. *British Journal of Sociology* **52**, 441–467.

Sorjonen, K., Hemmingsson, T., Lundin, A. & Melin, B. (2011) How social position of origin relates to intelligence and level of education when adjusting for attained social position. *Scandinavian Journal of Psychology* **52**, 277–281.

Steelman, L. C. & Powell, B. (1985) The social and academic consequences of birth order: real, artifactual, or both? *Journal of Marriage and Family* **47**, 117–124.

Sulloway, F. J. (1996) *Born to Rebel: Birth Order, Family Dynamics, and Creative Lives.* Pantheon, New York.

Tabachnick, B. G. & Fidell, L. S. (2006) *Using Multivariate Statistics.* Fifth edition. Allyn & Bacon, Boston.

Tomasson, R. F. (1966) Social mobility and family size in two high-status populations. *Eugenics Quarterly* **13**, 113–121.

Van Bavel, J., Moreels, S., Van de Putte, B. & Matthijs, K. (2011) Family size and intergenerational social mobility during the fertility transition. *Demographic Research* **24**, 313–344.

Von Stumm, S., Gale, C. R., Batty, G. D. & Deary, I. J. (2009) Childhood intelligence, locus of control and behaviour disturbance as determinants of intergenerational social mobility: British Cohort Study 1970. *Intelligence* **37**, 329–340.

Von Stumm, S., Macintyre, S., Batty, D. G., Clark, H. & Deary, I. J. (2010) Intelligence, social class of origin, childhood behavior disturbance and education as predictors of status attainment in midlife in men: the Aberdeen Children of the 1950s study. *Intelligence* **38**, 202–211.

Waller, J. H. (1971) Achievement and social mobility: relationships amongst IQ score, education and occupation in two generations. *Social Biology* **18**, 252–259.

Wolniak, G. C., Seifert, T. A., Reed, E. J. & Pascarella, E. T. (2008) College majors and social mobility. *Research in Social Stratification and Mobility* **26**, 123–139.

Zajonc, R. B. (1976) Family configuration and intelligence. *Science* **192**, 227–236.

Zajonc, R. B. & Markus, G. B. (1975) Birth order and intellectual development. *Psychological Review* **82**, 74–88.