Title
Cognitive Achievement of Children of Immigrants: Evidence from the Millennium Cohort Study and the 1970 British Cohort Study

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Cognitive achievement of children of immigrants: Evidence from the Millennium Cohort Study and 1970 British Cohort Study

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Abstract

Although numerous studies have described the educational attainment of ethnic minorities in the UK, few have focused specifically on children born in the UK to two immigrant parents. Using ordinary-least-squares (OLS) estimation, this paper examines the cognitive assessment scores of children of immigrants in the 1970 British Cohort Study (BCS70) and the Millennium Cohort Study (MCS). It then exploits the richer data of the MCS to construct multilevel models for children of immigrants in this more recent cohort. Whereas in the BCS70 children of immigrants show significant gaps at ages 5 and 10 in both reading and maths scores, in the MCS nearly no gap remains in age-11 and -14 assessments. Even when controls are included in the OLS model for the BCS70, children of Caribbean immigrants are expected to perform worse in both assessments. Although Bangladeshi children of immigrants in the MCS have negative coefficients in the OLS analysis, in the final multilevel model for the MCS all children of immigrants wherein no group attains distinguishably lower scores than their peers in later assessments, and Indian children of immigrants even outperform their peers in the MCS model's predictions.

Introduction

Since Coard's (1971) influential pamphlet, through prominent reports in the 1980s such as *The Swann Report* (Swann 1985), up to the new millennium (DfES 2006; Gillborn & Mirza 2000), the achievement (and often underachievement) of children of immigrants and ethnic minorities, as well as the hostile school environment in which they have repeatedly found themselves, have captured national attention in the UK. This is despite a long history of policy changes meant to address the issue: since at least as far back as the 1960s, the academic achievement of immigrant and minority ethnic children has found a place on the political agenda (Pilkington 2003; Rattansi 1992; Tikly et al. 2005). Policymakers have attempted a variety of solutions, from additional funding for language instruction to training teachers in minority ethnic achievement to the introduction of market logics and competition to schools (Back et al. 2002; Tikly et al. 2005).

With rising numbers of immigrants (Rienzo & Vargas-Silva 2017), the UK faces the essential task of promoting the success of their descendants; so long as immigrants and their descendants cannot fully participate and succeed in British society, social cohesion, the economy and well-being suffer (Pilkington 2003). Have decades of government focus on immigration, minority ethnic groups and achievement succeeded in helping these pupils 'catch up' to their White British peers in school? Although many studies have examined the achievement of minority ethnic groups in British schools, and some have zeroed in on English as an Additional Language (EAL) learners (e.g. Bhattacharyya et al. 2003; Strand et al. 2015), few researchers have examined the children of immigrants as a discrete group. Those who have either focus only on old data (Meunier et al. 2013) or make merely passing mention

of children of immigrants (Jerrim & Shure 2016). In addition, these studies rarely exploit longitudinal data, settling for less comprehensive cross-sectional analysis. This study attempts to fill this gap by conducting parallel analyses of contemporary and 30-year-old data as well as by exploiting the rich longitudinal possibilities of the more recent data.

Focusing on assessment scores from early years up to the early teens, this study aims to compare the cognitive scores of children of immigrants from the Millennium Cohort Study (MCS) to their counterparts thirty years earlier in the 1970 British Cohort Study (BCS70). By controlling for sociodemographic and other individual characteristics that might confound analysis — first through ordinary-least-squares (OLS) estimation of linear models for both studies and then a quadratic multilevel model for change for the MCS data — it seeks to determine if children of immigrants achieve along systematically different trajectories when compared to children of non-immigrants, focusing on differences across ethnic groups. The analysis below also attempts to ascertain whether children of immigrants today are performing better academically than their counterparts thirty years ago.

Background

Although focus on children of immigrants as a distinct group is rare in research in the UK, a great amount of evidence documents the disparate achievement trajectories of minority ethnic groups. This study is foremost an examination of children of immigrants, but when this data is unavailable, minority ethnic status in past years can be a good proxy. Bernard Coard (1971) first brought widespread attention to the discriminatory ability group placement of West Indian pupils, and *The Swann Report*'s (1985) detailed account of minority ethnic underachievement put the issue

on the policy agenda. Since then, dozens of studies have considered the achievement of ethnic minorities in the UK. For example, Gillborn and Mirza (2000) find that a policy focus on raising GCSE scores has not benefited African-Caribbean, Bangladeshi and Pakistani pupils equally, contributing to rising inequality and disadvantaging pupils for later education and employment. A report by the Department for Education and Skills (2006) found that black, Pakistani and Bangladeshi pupils on average had lower levels of attainment on Key Stage assessments than their peers, whereas Indian and Chinese pupils performed better than the group average. Almost all minority ethnic groups made more progress through primary and secondary school than their White British peers, with the exception of Black Caribbean pupils in primary school. These trends in academic progression were echoed by Wilson et al. (2009) in their analysis of the National Pupil Database and by Dustmann et al. (2010) in analysis of Key Stages 1 and 4, with Black Caribbean pupils — especially boys — not closing the gap like other ethnic minorities. Kingdon and Cassen (2010) as well as Strand (2010) also identify Black Caribbean boys falling the farthest behind, but find the effects of poverty to be more powerful on White British pupils than on ethnic minorities in contributing to lower assessment scores. Although Black Caribbean students demonstrate achievement gaps in many studies, it should be noted that similar effects are generally not observed for Black African children (Strand, 2015).

One notable study that does look at children of immigrants directly is by Meunier et al. (2013), who examine the BCS70. The authors find that children of South Asian and African Caribbean immigrants tended to perform worse on Key Stage 1 tests (age 5) than their peers whose parents were born in the UK or Europe, even when controlling for English as an Additional Language (EAL) enrolment, socioeconomic

status and other individual characteristics. They also determine, however, that by Key Stage 2 (age 10) the gap narrows for children of South Asian immigrants, while children of parents from Africa and the Caribbean do not improve, on average. One other study by Jerrim and Shure (2016) looks at the education of children of immigrants within the wider context of PISA scores in England. The authors find somewhat different trends for ethnic minorities than those listed above: white pupils outperform ethnic minorities in all categories (science, math and reading), and children of immigrants perform worse than children of non-immigrants in science and slightly (though statistically insignificantly) worse in math and reading. A few other studies chronicle the social mobility of immigrants' offspring, who on average do better economically than their parents but worse than their white peers without immigrant heritage (Algan et al. 2010; Dustmann & Theodoropoulos 2010; Heath & McMahon 2005). Studies of the academic attainment of children of immigrants are more forthcoming at the European level, mostly finding achievement gaps (Colding 2006; Riphahn 2003; Shapira 2012; van Ours & Veenman 2006).

Although this study's main goal is to shed light on an area of academic disadvantage that has gone neglected, it also attempts to consider what theories of achievement might be most useful in explaining the academic outcomes of children of immigrants. Economic, cultural and discriminatory factors have often been invoked as possible causes. It is no secret that ethnic minorities and immigrant groups are disproportionately afflicted by poverty and lower socioeconomic status in the UK (Platt 2007; Rienzo & Vargas-Silva 2017). Poverty has been shown numerous times to hamper school performance (Mortimore & Whitty 1997; Spencer 2000), which is compounded by the fact that minority ethnic children are likely to be concentrated in poorer neighbourhoods (Jivraj & Khan 2013) and attend schools with many EAL

learners (Strand et al. 2015) and children from low socioeconomic backgrounds (Tomlinson 1990).

Cultural factors such as non-native English-speaking backgrounds certainly tell part of the story; Bhattacharyya et al. (2003) find that although EAL pupils make greater progress than their non-EAL peers, lowercase???Black, Bangladeshi and Pakistani EAL learners still perform worse on average than other pupils on Key Stage tests, and Strand et al. (2015) describe EAL pupils as usually achieving worse in assessments at young ages, but catching up to their peers by age 16. But cultural differences arguably go much deeper than language. Bourdieu's (1977; 1986) theory of 'cultural capital' posits that power and status can be accumulated and transferred from parent to child in a process that maintains social hierarchies. Brooker (2015) argues that this is the case with early childhood education (ECE) in recent years; children in ECE who do not come prepared with the dominant capital may be labelled in ways that disadvantage them. Later on these children may experience a hostile school environment, developing what Ogbu (1992, p. 9) calls 'secondary cultural differences' that result from a ‘new sense of social or collective identity [. . .] in opposition to the social identity of the dominant group'. These minorities, so long as they recognise the school as a hostile environment, may eschew academic learning as detrimental to their sense of self-worth, identity and social prospects, as corroborated by Sewell (1997) for black boys in British schools and Archer (2003) regarding Muslim boys.

Discrimination and racism have been documented repeatedly in the assigning of minority ethnic students, especially Black Caribbean boys, to lower-'ability' sets in school (Coard 1971; Tomlinson 1990) or receiving harsher treatment in the classroom (e.g. Mac an Ghaill 1988; Tomlinson 1990; Wright 1992). In England,

Black Caribbean pupils are almost three times more likely than white pupils to be permanently excluded from school (DfE 2016), a counterproductive process that harms the pupil and community (Wright 2013), and they are entered for higher tiers of national tests at systematically lower rates, even when a wide variety of socioeconomic and environmental factors are controlled for (Strand 2012). Racism and discrimination likely play at least some part in these disproportionate punishments and academic outcomes, although prejudice ‘cannot be pinned down by controlling conventional environmental variables’ (Kohn 1995), and only a (near impossible) randomised controlled trial could demonstrate convincing causal influence.

All of these theoretical factors will be explored as determinants of the multilevel model in later sections. In considering the studies discussed above as well as this paper's focus, it is important to concentrate not only on *underachievement* but on *achievement* as well. The story is complicated for all students and groups of students, and many in the most 'disadvantaged' groups excel and perform extremely well in school (Archer & Francis 2007; Rhamie & Hallam 2002).

Methodology

This study tests the hypothesis that children of immigrants in the Millennium Cohort Study perform better in their cognitive assessment scores than their counterparts in the 1970 British Cohort Study. This is done in two ways: first, ordinary least squares (OLS) is used to estimate models for the first two waves of assessment data for each cohort. Then, exploiting the five available waves of assessment data for the Millennium Cohort Study, this study takes a closer look at this more recent data by using maximum likelihood estimation (MLE) to estimate multilevel models for

change, also known as growth modelling, for cognitive growth trajectories over time. Due to large amounts of missing data in the fourth wave of the 1970 British Cohort Study, a multilevel model was not advisable for this dataset.

1970 British Cohort Study

Both the 1970 British Cohort Study (BCS70) and the Millennium Cohort Study (MCS) are administered by the Centre for Longitudinal Studies (CLS), based in the Institute of Education at University College London. The BCS70 follows all people born in England, Scotland and Wales in one week in April 1970 (Elliott & Shepherd 2006). The study began with 16,571 observed participants, and the third survey, in 1980, involved 14,350 remaining cohort members (Plewis et al. 2004). Each survey collects wide-ranging data on social behaviour, medical records, parents, parenting practices and a host of measurements and assessments. Although this cohort has contributed to eight surveys, also called 'data sweeps' or ‘waves’, up to age 42, this study focuses on only the first three (ages 0, 5, 10) for the sake of comparability with the completed sweeps of the Millennium Cohort Study. Due to a teachers strike during the fourth sweep (1986), most age-16 scores are unavailable for analysis (Parsons 2014).

The present study assessments that test similar skills in order to fit two sets of models for each cohort. A reading model for the BCS70 includes Schonell Reading (ages 5 and 10), while a maths model is fit for Copying Designs (age 5) and Friendly Maths (age 10). Assessment scores for both the BCS70 and MCS underwent the same transformation within each wave to give them a mean of 50 and standard deviation of 10 (with survey weights used in the MCS transformations). This approach has two weaknesses: it compares tests that were not necessarily meant to

be compared, and it relies on assessments that cannot be generalised as easily as nationally administered exams such as the Key Stage tests. Its advantages are that it allows rich data for a multilevel model (for the MCS), and access to the data is much simpler than for Key Stage scores. It should also be mentioned that this standardisation technique shows deviations from the group mean of 50; one cohort member's gain in points could result from other cohort members falling behind, or vice versa.

In the final OLS models for BCS70 assessment scores, number of immigrant parents (derived from parental birthplace) and six-category ethnicity constitute the variables of interest, with ethnic groups defined as white, mixed ethnicity, Indian, Pakistani, Caribbean and other ethnicities. Controls include gender, birth order, home language environment (whether English was the main language at home in Wave 2), family income at age 10, parental marital status, father's occupation (or mother's if missing) at age 5 and region of residence at age 5 (the final two are lagged for the sake of causal inference).

Millennium Cohort Study (MCS)

The MCS drew its participants from all babies born in the UK over twelve months, beginning 1 September 2000 in England and Wales and 1 December 2000 in Scotland and Northern Ireland (Plewis 2007). Sampling made use of disproportionate stratification to ensure adequate representation of economically deprived regions and (in England) areas with high proportions of black and Asian families (Plewis 2007). Although the study began with 18,818 children in 18,552 families, in the sixth and most recent wave (2015-2016), 11,872 children in 11,726 families remained (Fitzsimons 2017). The study is designed to provide extensive

information on diverse topics, including health, parenting, inequality, and education, with more detail and regularity than the BCS70 (Hansen 2014).

This study fits separate models for MCS verbal and quantitative scores. For the multilevel models, the verbal score analysis makes use of Waves 2 through 6: BAS Naming Vocabulary (ages 3 and 5), BAS Word Reading (age 7), BAS Verbal Similarities (age 11) and Word Activity (age 14). Quantitative assessments analysed include BSR Numbers/Counting (age 3), BAS Pattern Construction (age 5), NFER Number Skills (age 7) and CANTAB Spatial Working Memory Task (age 11); unfortunately no quantitative assessment was administered at age 14. At age 7, NFER Number Skills was chosen over the second BAS Pattern Construction for the quantitative model in order to maintain the trend of different assessments administered in each wave.

In the final MCS models, variables of interest comprise number of immigrant parents (derived from parental birthplace) and a seven-category ethnicity variable that differentiates white, mixed ethnicity, Indian, Pakistani, Bangladeshi, Black African and Other ethnicities. Due to low numbers of Black Caribbean children of immigrants, this ethnic group was dropped from the sample. Time-invariant controls cover gender, birth order and sampling region, whereas time-variant controls include household income, region of residence, home language environment (English only, multilingual or no English), number of siblings, number of parents/carers, parental educational qualifications (5-category NVQ) and parental occupational class (5-cateogry NS-SEC). In the OLS models, time-variant controls from age 7 as well as an average of non-missing age-3, -5 and -7 scores are used to predict age-11 scores. Age in years at time of assessment, not wave number, are used as the time variable in the multilevel models.

Results

Descriptive statistics

Tables 1 and 2 present the sample for the two BCS70 waves included in analysis, as determined by complete cases for the final OLS model. Due to very low numbers of Bangladeshi children, this group was removed from analysis of the BCS70, and trajectories for the small numbers of children of mixed and Other ethnicities will not be examined. Due to smaller numbers of children of immigrants, analyses of the BCS70 that focus on children of immigrants as a single group are likely more reliable.

Table 1. BCS70 sample for reading scores, by ethnicity and 0, 1 or 2 immigrant parents

	Wave 2 (age 5)			Wave 3 (age 10)		
Total sample	8,678			8,281		
No. of immigrant parents	None	One	Two	None	One	Two
Total	7,864	473	341	7,527	448	306
Ethnicity						
White	7,862	443	178	7,527	418	149
Mixed	2	26	11	0	28	8
Indian	0	0	52	0	0	70
Pakistani	0	0	16	0	0	20
Bangladeshi	0	0	1	0	0	0
Caribbean	0	2	80	0	2	59
Other	0	2	3	0	0	0

Table 2. BCS70 sample for maths scores, by ethnicity and 0, 1 or 2 immigrant parents

	Wave 2 (age 5)			Wave 3 (age 10)		
Total sample	11,015			8,281		
No. of immigrant parents	None	One	Two	None	One	Two
Total	9,959	595	461	7,528	448	305
Ethnicity						
White	9,957	558	224	7,528	418	148
Mixed	2	33	14	0	28	8
Indian	0	0	94	0	0	70
Pakistani	0	0	34	0	0	20
Bangladeshi	0	0	1	0	0	0
Caribbean	0	2	91	0	2	59
Other	0	2	3	0	0	0

Simply looking at mean scores based on number of immigrant parents and ethnicity reveals a number of associations (Figures 1 and 2). Unlike the MCS, the BCS70 data do not contain weights to correct for attrition, so these figures present raw means. At age 5, children of two immigrants have significantly lower verbal scores and somewhat lower maths scores than children whose parents were both born in the UK. For verbal scores, this is especially true for Indian and Pakistani children, and for maths scores Pakistani children are at the bottom of the ranking. By age 10, the gap for verbal scores has narrowed from about 8 to 3 points, but the average maths score for children of two immigrants remains unchanged at about 3 points lower than their peers, and the gap for Caribbean children has actually widened.

Figure 1. BCS70 mean scores, by number of immigrant parents with 95% confidence intervals

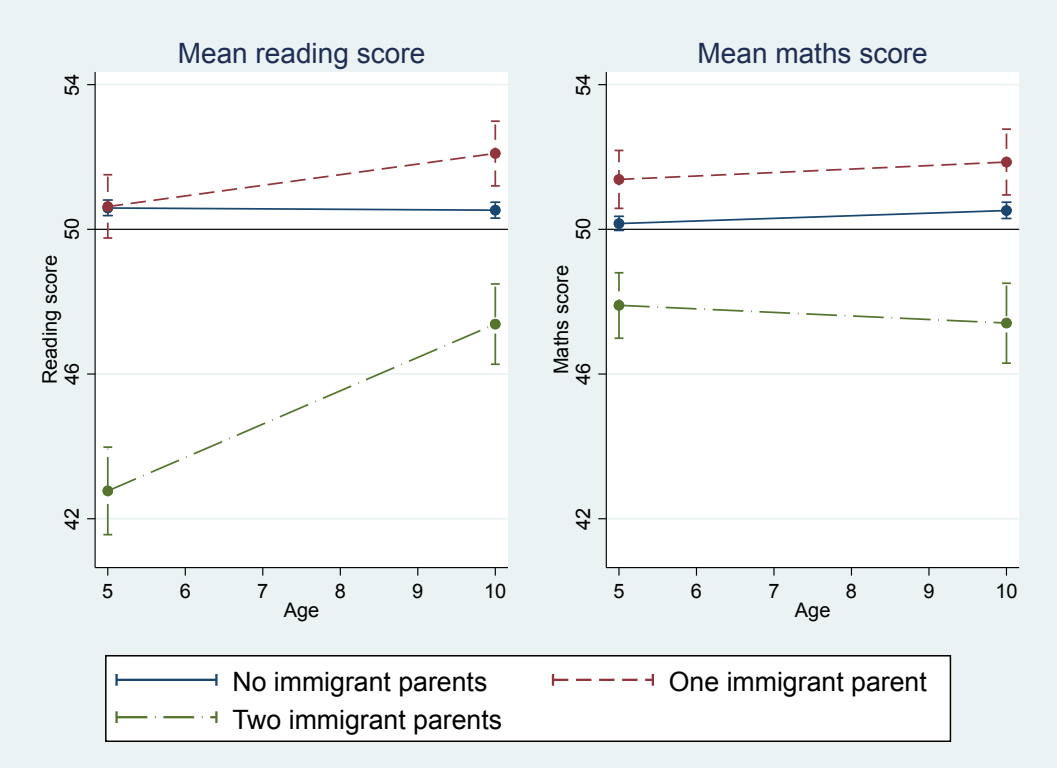
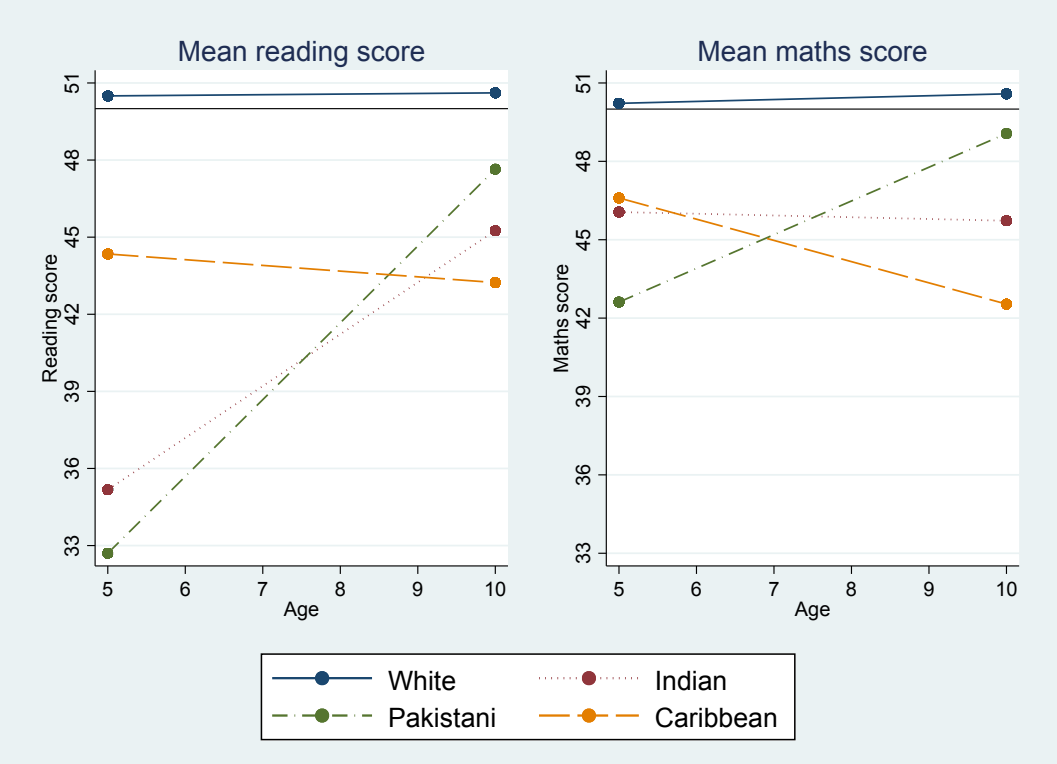


Figure 2. BCS70 mean scores, by ethnicity



The MCS has much data available for its young cohort members (see Tables 3 and 4). The trends seen in the BCS70 data are somewhat mirrored in the MCS, which includes sample and attrition weights that have been applied to the descriptive statistics (Figures 3 and 4). In age-3 scores they are similar: verbal scores are 12 points lower for children of two immigrants than they are for children of British-born parents, whereas quantitative scores are only slightly lower, with a gap that is not statistically significant at the 5% level of confidence. Pakistani and Bangladeshi children have the lowest age-3 verbal scores and, to a lesser extent, quantitative scores. Although none of the ethnic groups of children of two immigrants has higher mean age-3 quantitative scores than their peers, only Pakistani and Bangladeshi children have scores that are significantly different from the sample mean at the 5% level.

Table 3. MCS sample for verbal scores, by ethnicity and number of immigrant parents

	Wave 2 (age 3)			Wave 3 (age 5)			Wave 4 (age 7)			Wave 5 (age 11)			Wave 6 (age 14)		
Total sample	9,827			8,804			7,928			8,339			7,071		
No. of immigrant parents	None	One	Two	None	One	Two	None	One	Two	None	One	Two	None	One	Two
Total	8,159	1,053	615	7,248	919	637	6,485	853	590	6,850	868	621	5,738	762	571
Ethnicity															
White	7926	597	86	7061	534	85	6314	469	69	6654	477	67	5570	416	54
Mixed	102	79	23	86	61	23	77	57	23	83	58	23	69	53	23
Indian	56	104	120	47	91	116	44	85	107	46	88	110	36	78	99
Pakistani	18	192	157	8	164	154	13	164	152	18	168	157	14	146	150
Bangladeshi	4	9	85	3	11	89	1	14	87	3	13	103	3	11	95
Black Caribbean	33	18	7	25	14	7	22	17	6	29	17	5	26	15	7
Black African	4	34	47	4	25	44	4	29	39	3	30	47	4	26	44
Other	16	20	90	14	19	119	10	18	107	14	17	109	16	17	99

Table 4. MCS sample for quantitative scores, by ethnicity and 2 or 1 immigrant parents

	Wave 2 (age 3)			Wave 3 (age 5)			Wave 4 (age 7)			Wave 5 (age 11)		
Total sample	9,868			8,775			8,038			8,103		
No. of immigrant parents	None	One	Two	None	One	Two	None	One	Two	None	One	Two
Total	8,199	1,055	614	7,224	914	637	6,592	857	589	6,673	838	592
Ethnicity												
White	7965	604	90	7037	529	85	6419	474	69	6486	468	66
Mixed	103	77	23	86	61	23	77	56	23	81	55	23
Indian	57	100	113	47	91	116	44	85	107	41	80	102
Pakistani	18	191	160	8	164	153	13	164	151	15	161	150
Bangladeshi	4	11	82	3	11	90	2	14	87	3	13	100
Black Caribbean	33	16	8	25	14	7	22	17	6	30	16	5
Black African	4	34	47	4	25	44	4	29	39	3	29	47
Other	15	22	91	14	19	119	11	18	107	14	16	99

By age 14, on the other hand, the MCS verbal score gap narrows to become indistinguishable, whereas by age 11 the quantitative score gap is slightly wider (at 1.7 points) and now statistically significant. This varies by ethnicity: children of immigrants of mixed, Pakistani and Black African ethnicities have lower age-14 verbal scores than other cohort members, and for quantitative scores, means of all children of immigrants except the slightly lower scores of Pakistani, Bangladeshi and black ethnic groups are indistinguishable from the sample mean.

Figure 3. MCS mean scores, by number of immigrant parents (with survey weights and 95% confidence intervals)

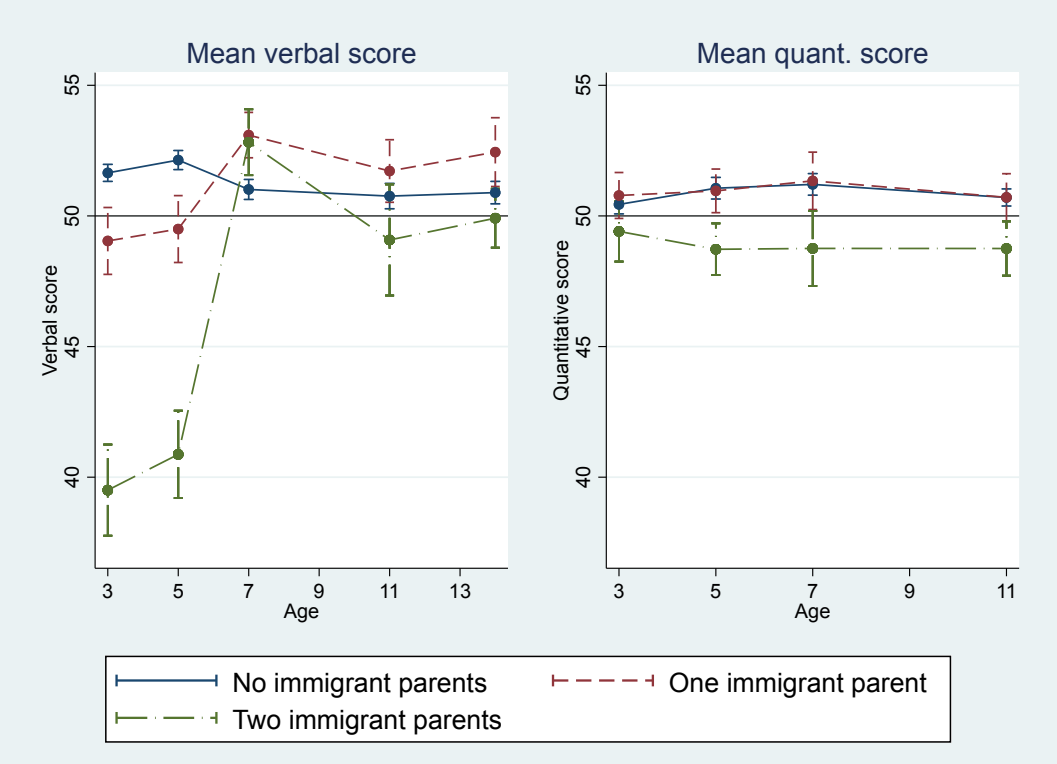
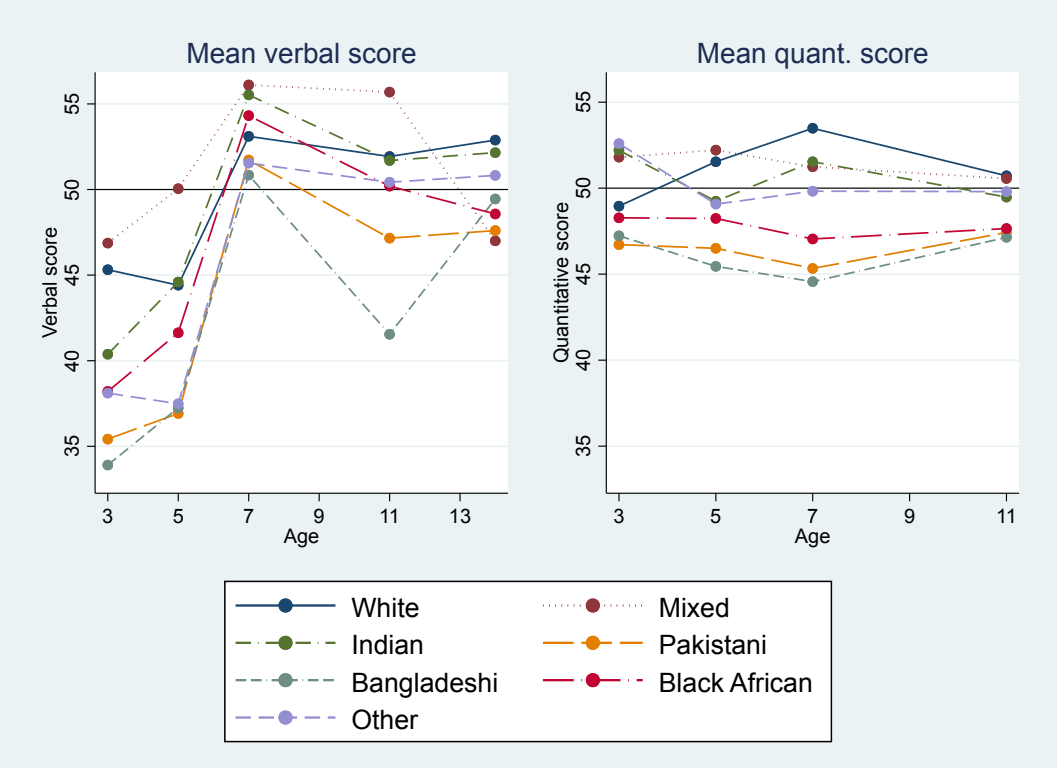


Figure 4. MCS mean scores for children of two immigrants, by ethnicity (with survey weights)



Ordinary-least-squares (OLS) models

For each cohort, three OLS models for age-10 or -11 assessment score are included for comparison:

- Model A: only controls for number of immigrant parents.
- Model B: controls for number of immigrant parents and ethnicity.
- Model C: Model B with controls for previous wave's assessment score (age 5 for the BCS70 and age 7 for the MCS) as well as individual and family characteristics.

For the BCS70 (Table 5), Model A demonstrates a clear gap between children of immigrants and children of native-born parents (the base category) in both reading and maths scores at age 10, with coefficients of -1.7 and -3.1, respectively. When 6-

category ethnicity is included, however, with white as the base category, coefficients for children of two immigrants are no longer significant. Because nearly all ethnic minorities in this sample are children of immigrants, the coefficients for ethnicity in Model B have mostly absorbed the effect; the insignificance of the two-parent coefficient demonstrates that white children of immigrants perform no differently than native-born white children. The coefficient for Caribbean children shows the greatest deviation in both reading and maths scores. Indian children do not perform significantly worse in reading but do in maths.

Finally, in Model C, which controls for confounding factors such as socioeconomic status and home language environment as well as age-5 assessment score, the negative coefficients for Caribbean children have been only slightly attenuated. On the other hand, all other ethnic groups of children immigrants are now expected to perform more than 3 points better than their peers in reading and no different in maths.

Table 5. BCS70 OLS models for age 10 (wave 3) reading and maths scores

	BCS70 Reading scores			BCS70 Maths scores		
	Model A	Model B	Model C	Model A	Model B	Model C
Controls?[a]	No	No	Yes	No	No	Yes
No. of immigrant parents						
One	1.68***	1.83***	1.28**	1.34**	1.37**	0.38
Two	-1.74**	0.25	3.43***	-3.07***	-0.54	0.95
Ethnicity (white=base)						
Mixed		-2.31	-0.96		-0.60	-0.05
Indian		-1.27	1.16		-3.94**	-1.10
Pakistani		-2.84	2.57		-2.27	1.89
Caribbean		-6.71***	-6.45***		-7.59***	-5.90***
Other		12.68	15.90		18.47	13.34
N	7198	7198	7198	9287	9287	9287
R-squared	0.003	0.006	0.238	0.005	0.008	0.281
Adjusted R-sq.	0.002	0.005	0.233	0.004	0.008	0.277

[a] Model C controlled for gender, birth order, home language environment, state benefits receipt, parental marital status, weekly family income at age 10, mother's and father's ages at end of education when child was 5, parental occupation at age 5, region of residence at age 5 and respective age-5 assessment score.
* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Linear models for MCS age-11 scores were estimated using OLS (Table 6) for the sake of comparability with BCS70 models, but richer analysis will follow in the presentation of multilevel models below. As in the BCS models, clear gaps between children of two immigrants in the MCS and their peers exist in the uncontrolled Model A for both verbal and quantitative scores. When ethnicity is included in Model B (with white as the base category), the coefficient for children of two immigrants similarly becomes insignificant, although in this sample ethnic minorities contain many children with both parents born in the UK. This implies that ethnicity might be more important than parental birthplace in the MCS; this will be examined in more detail below by using interactions in the multilevel models.

According to Model B, Pakistani and Bangladeshi children perform significantly worse than their peers, especially in verbal but also in quantitative scores. When controls — including an average of non-missing age-3, -5 and -7 scores — are added in Model C, children of two immigrants are now expected to perform better than their peers in verbal scores, except for Bangladeshi children, who continue to lag somewhat behind. Indian children are now expected to perform especially better in verbal assessments. In quantitative scores, on the hand, Model C does not predict children of immigrants and ethnic minorities to score any differently than their peers.

Table 6. MCS OLS models for age 11 (wave 5) verbal and quantitative scores

	Verbal scores			Quantitative scores		
	Model A	Model B	Model C (controls)[b]	Model A	Model B	Model C (controls)[b]
No. of immigrant parents						
One	0.23	1.37**	0.93*	-0.17	0.53	-0.20
Two	-2.32***	0.43	2.13***	-1.80***	-0.23	-0.05
Ethnicity (white=base)						
Mixed		0.32	-0.11		0.05	-0.76
Indian		0.90	3.13***		-0.37	-0.02
Pakistani		-6.03***	1.63*		-2.80***	-0.64
Bangladeshi		-8.66***	-2.24*		-3.29**	-0.77
Black African		1.49	2.76*		-2.22	-1.90
Other		-0.73	2.28*		-0.83	-0.12
N	7238	7238	7238	7031	7031	7031
R-squared	0.004	0.023	0.241	0.002	0.005	0.074
Adjusted R-sq.	0.004	0.022	0.236	0.002	0.004	0.067

[b] Model C controlled for gender, birth order, sampling region, age-7 household income, age-7 home language environment, age-7 number of siblings, age-7 region of residence, age-7 number of household parents/carers, age-7 highest parental NVQ (education), age-7 highest parental NS-SEC (occupational class) and an average of non-missing age-3, -5 and -7 scores.

* = p < 0.05, ** = p < 0.01, *** = p < 0.001

Multilevel models

Table 7 presents four multilevel models for MCS scores at ages 3, 5, 7, 11 and (for verbal scores) 14. These include:

- Model A: only controls for number of immigrant parents.
- Model B: controls for number of immigrant parents and 7-category ethnicity.
- Model C: Model B with controls for individual and family characteristics.
- Model D: Model C with a quadratic component.

Each model estimates parameters for both initial status and linear slope (rate of change) and treats these components as random effects; Model D adds a quadratic component, but random-effects parameters are not estimated for this (such a model does not converge). Examinations of residual normality and homoscedasticity were successful for all models included.

Benefiting from relatively large numbers of ethnic minorities in the sample, models B, C and D interact ethnicity with number of immigrant parents to obtain more specific effects. (White is the base category for ethnicity, and zero immigrant parents the base category for ‘Imm. parents’.) Table 7 presents the sums of these interactions for children of two immigrants under ‘Ethnicity*2 imm.’ For example, Model B's coefficient for Indian initial verbal score, -2.62, sums the coefficient for Indian ethnicity (-4.48) with that for Indian children of two immigrants (1.86). Joint significance (and significances stars) for the resulting sums was determined using Wald tests. Significance of coefficients for numbers of immigrant parents represents the results of t tests.

Table 7. MCS verbal and quantitative multilevel models

	Verbal scores				Quantitative scores			
	Model A	Model B	Model C	Model D	Model A	Model B	Model C	Model D
N[c]	10,578	10,578	10,578	10,578	10,553	10,553	10,553	10,553
Controls?[d]	No	No	Yes	Yes	No	No	Yes	Yes
Initial status								
Imm. parents								
One	-3.32***	0.20	-0.32	-0.29	0.13	1.20**	0.30	-0.22
Two	-12.11***	-6.80	-4.36***	-5.57***	-2.40***	-0.93	-1.35	-3.20**
Ethnicity*2 imm.[e]								
Mixed		2.07	1.98	-0.81		2.85**	3.24*	4.83*
Indian		-2.62***	0.43	-2.09**		0.28	1.75	3.09
Pakistani		-7.87***	-2.24***	-4.74***		-4.01**	-0.63	1.49
Bangladeshi		-9.09***	-2.99*	-5.36***		-3.56*	-0.30	1.54
Black African		-4.95**	-1.52	-3.38		-1.35	0.71	2.26
Other		-7.38***	-3.40**	-5.92***		0.14	1.75	2.88
Linear slope								
Constant	-0.03**	-0.04***	0.12	-0.26	0.07***	0.08***	0.14	-1.36**
Imm. parents								
One	0.50***	0.27***	0.21***	0.16	-0.05	-0.05	-0.02	0.52*
Two	1.18***	0.93***	0.57***	1.31**	0.03	0.39*	0.43*	2.19***
Ethnicity*2 imm.[e]								
Mixed		-0.40	-0.31	1.54		-0.68*	-0.70*	-2.24
Indian		0.28***	0.11	1.87***		-0.53	-0.61*	-1.97*
Pakistani		0.29***	0.22**	1.87***		-0.20	-0.33	-2.33**
Bangladeshi		0.33	0.20	1.59*		-0.40	-0.44	-2.15*
Black African		0.20	-0.02	1.37		-0.44	-0.62	-2.23
Other		0.59***	0.36*	1.71**		-0.47	-0.47	-1.68
Quadratic								
Constant				0.03				0.18**
Imm. parents								
One				0.01				-0.06*
Two				-0.06				-0.21**
Ethnicity*2 imm.[e]								
Mixed				-0.16				0.18
Indian				-0.15**				0.17
Pakistani				-0.14**				0.24*
Bangladeshi				-0.11				0.21
Black African				-0.12				0.20
Other				-0.11				0.15
Level-1 variance								
Within-person	59.72	59.73	60.20	58.06	71.84	71.83	71.86	70.62
Level-2 variance								
Initial status	37.72	33.73	22.29	23.51	28.91	28.09	22.69	23.33
Linear slope	0.19	0.17	0.14	0.16	0.41	0.41	0.38	0.41
Covariance	-0.68	-0.42	-0.17	-0.29	-1.66	-1.64	-1.45	-1.55
Deviance	303147	302538	300306	299421	254831	254646	253445	253145
AIC	303167	302630	300562	299801	254851	254738	253701	253525
BIC	303253	303027	301668	301443	254936	255127	254782	255131

[c] Number of unique individuals. Number per wave presented in Tables 3 and 4.

[d] Models C and D controlled for gender, birth order, sampling region, region of residence, household income, home language environment, number of siblings, number of household parents/carers, highest parental NVQ (education) and highest parental NS-SEC (occupational class).

[e] Combined effects of ethnicity and the interaction between children of two immigrants and ethnicity. Significance based on Wald test of joint significance of these two components.

* = p < 0.05, ** = p < 0.01, *** = p < 0.001

The negative covariance (verbal correlation = -0.26, quantitative correlation = -0.48) of initial status and rate of change in Model A demonstrates that children who have lower scores at age 3 usually improve more quickly than their peers. This model also demonstrates that children of two immigrant parents have a starting verbal score that is on average 12.11 points, or more than one standard deviation, lower than cohort members with British-born parents. However their rate of change is 1.18 points per year higher than the slightly negative yearly progression of children of non-immigrants. These effects are much smaller for quantitative scores; children of immigrants begin a quarter of a standard deviation lower than their peers, and their rate of change is indistinguishable from the nearly zero mean rate, so in the raw data they do not catch up to their peers.

Model B introduces interactions between ethnicity and number of immigrant parents, demonstrating that minority ethnic children of immigrants have lower beginning verbal scores, but all children of immigrants have slope advantages, especially children of Indian, Pakistani and Other ethnicities. In quantitative scores, children of immigrants of mixed ethnicity have a higher initial score, whereas Pakistani and Bangladeshi children have lower initial scores, and the slope coefficient for children of immigrants is positive for all but those of mixed ethnicity.

Models C and D introduce controls, with Model D also including quadratic terms. Both models are presented, but likelihood ratio tests demonstrated that Model D was a stronger choice for both verbal and quantitative scores, and so we focus on this final model. In Model D, many of the effects in Model B are attenuated but mostly still significant. Most children of immigrants now have a starting verbal score that is a significant 4.36 points lower than their peers, and children of immigrants of Indian,

Pakistani, Bangladeshi and Other ethnic backgrounds begin an additional 2 to 6 points lower. White, mixed and Black African children of immigrants are associated with a linear slope advantage for verbal score of at least 1.3 points per year, with children of Indian, Pakistani, Bangladeshi and Other immigrants benefiting from even higher rates. Despite these slope advantages, negative quadratic coefficients for Indian and Pakistani children of immigrants demonstrate a trend of diminishing returns that attenuates these groups' linear slope advantages over time.

In the controlled quadratic model for quantitative scores, most children of immigrants begin with a significant score disadvantage of 3.2 points, except for children of mixed ethnicity. The slope coefficient for children of immigrants has grown and become more positive compared to Model B. This is less true for children of Indian and Bangladeshi immigrants, and Pakistani children of immigrants suffer a slope penalty. The negative quadratic coefficient for children of immigrants demonstrates diminishing returns over time, except for Pakistani children of immigrants.

In sum, even when controls are applied, children of immigrants in the MCS tend to have lower starting assessment scores than their peers, but many also benefit from slope advantages, narrowing their deviance from the mean score of 50 despite some quadratic disadvantages. Do the slope advantages of some groups allow them to catch up by the most recent assessment, when possible confounding factors are held constant? The findings from this study suggest that they do. Figure 5 presents predicted scores using Model C for children of zero, one or two immigrants. In this model, children of immigrants on average overtake their peers in verbal scores, rising from a 5.5-point negative gap at age 3 to a 1-point positive (albeit insignificant)

one at age 14. Predicted quantitative scores for children of immigrants also rise, but are not significantly different at the 5% level from their peers' at ages 3 or 11.

In Figure 6, predicted verbal scores demonstrate that in all ethnic groups, children of immigrants attain slightly lower scores than the average of 50 at age 3. By age 14, however, none of these groups performs below average, and children of Indian immigrants exceed the average by a significant 2.2 points. At the 5% level, no group attains lower verbal scores than children of non-immigrants in this final assessment. In initial quantitative scores, only Pakistani and Bangladeshi children of immigrants attain lower scores than children of British-born parents, and this effect is barely significant. By age 11, the quantitative scores of children of immigrants of any ethnic group do not differ significantly from the average. Overall, the MCS scores predicted using Model D show that children of immigrants tend to succeed in these assessments.

Figure 5. MCS Model D predicted scores, by number of immigrant parents with 95% confidence intervals

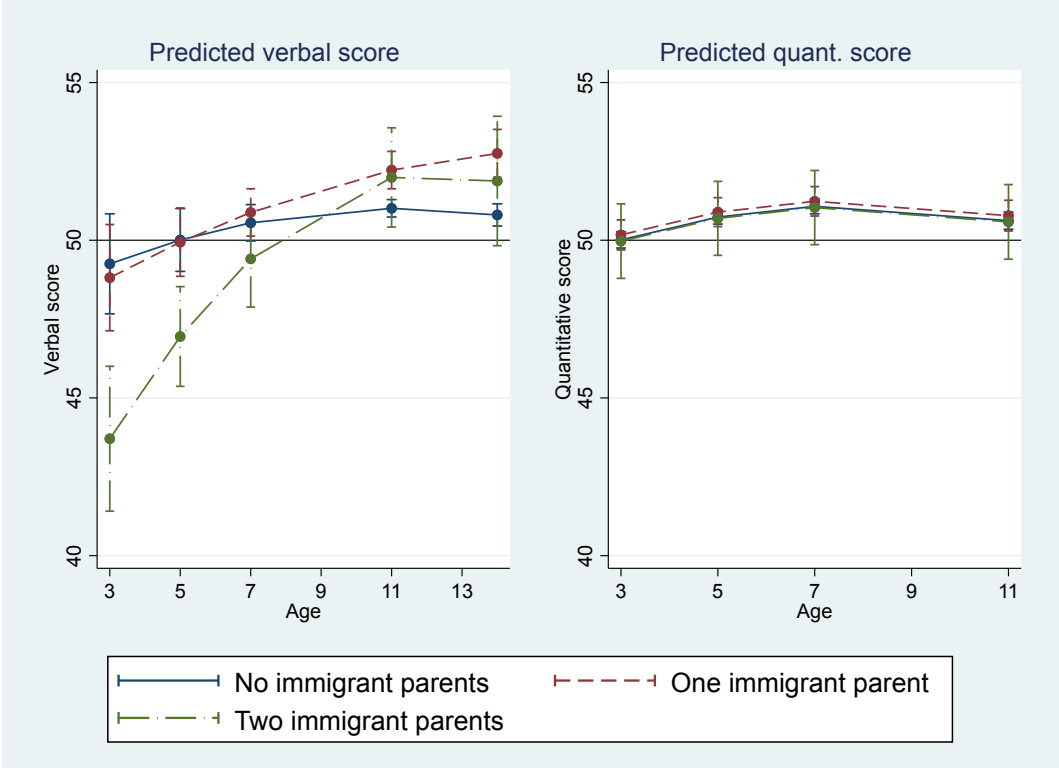
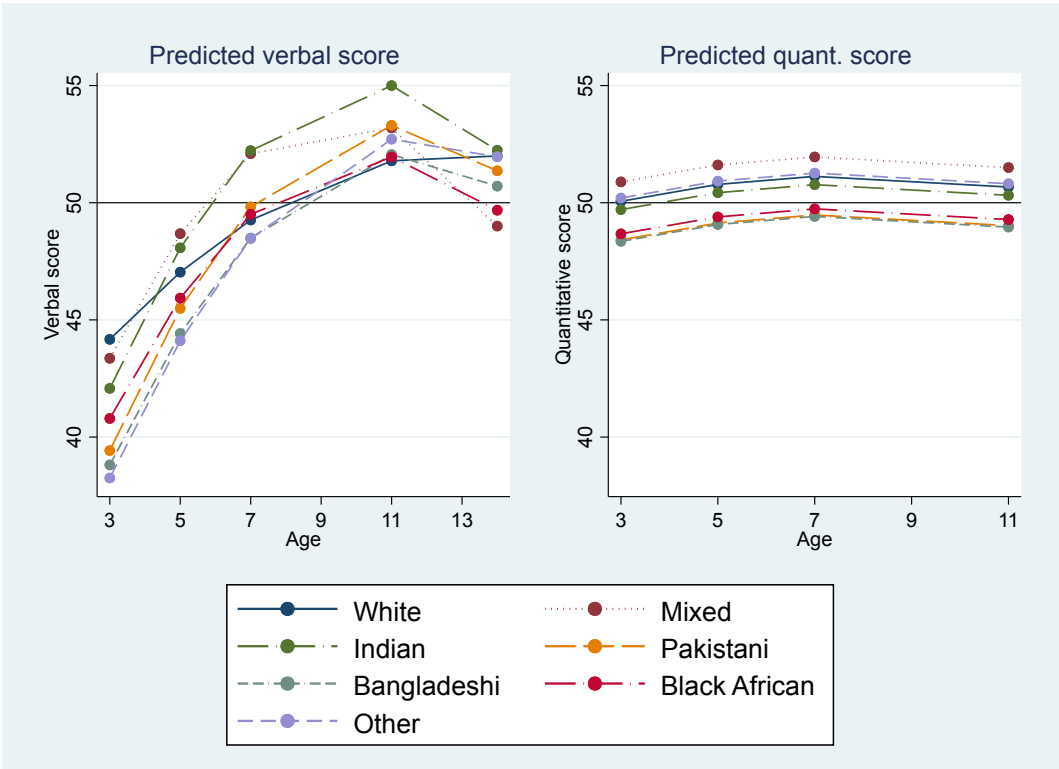


Figure 6. MCS Model D predicted scores for children of two immigrants, by ethnicity



Discussion and conclusion

Analyses of children of immigrants in the BCS70 and MCS tell a similar story, but differ in some significant aspects. In the BCS70 raw data, the gap for reading scores narrows but is still present at age 10, and the gap in maths scores remains roughly constant from ages 5 to 10. Uncontrolled data in the MCS, on the other hand, demonstrate an elimination of the gap for verbal scores by age 14, whereas a maths gap becomes distinguishable in later assessments. Before controls are introduced, the achievement for children of immigrants in the BCS70 does not close, whereas in the MCS it mostly does. In the OLS analyses, including controls reveals an advantage for most children of immigrants in BCS70 reading scores and MCS verbal scores and no significant difference for maths and quantitative scores. Notable exceptions to this trend include Caribbean children in both BCS70 assessments and Bangladeshi children in MCS verbal scores.

The richer multilevel analysis of MCS scores demonstrates that the verbal gap for Bangladeshi children may not be as serious as the OLS models might lead us to believe. Exploiting data from up to five assessments, the final multilevel models do imply lower age-3 scores for children of immigrants — especially for children of Pakistani, Bangladeshi and Other ethnicities — but almost all groups benefit from linear slope advantages, which help close this initial gap. Although an age-3 gap in verbal scores remains in this model's predictions, predicted final verbal scores, as well as predicted initial and final quantitative scores, show no significant difference between any ethnic group of children of immigrants and their peers.

This study finds support for the hypothesis that children of immigrants in the MCS do achieve greater overall success in their cognitive score trajectories, both controlled and uncontrolled, than their counterparts in the BCS70.

The takeaways from this study are altogether more encouraging than what many similar studies have found. On the one hand, the analysis above comes to similar, uncomfortable conclusions for the BCS70 that Meunier et al. (2013) did in their study of Key Stage scores in the same cohort, in that children of Caribbean immigrants lag behind their peers throughout the timeframe examined. But the present analysis also finds that children of immigrants generally surpass their peers in reading, which Meunier et al. (2013) did not discuss. Analysis of the MCS data comes to generally optimistic conclusions. Like Jerrim and Shure (2016), it finds no significant difference between scores of children of immigrants in verbal and quantitative skills, although it could not replicate their study's comparison of science scores. The raw data, however, do reflect the findings recorded by Gillborn and Mirza (2000) and the DfES (2006), in that black, Bangladeshi and Pakistani children attain somewhat lower scores than their peers even in later assessments. But in this paper, these disparities disappear when controls are introduced in multilevel models. Like DfES (2006), this study finds that Indian pupils generally do well in later assessments, at least in verbal skills. After controls are added, the models used do not show an achievement gap in later waves for Black African children of immigrants. This is to the difference of such authors as Wilson et al. (2009), Dustmann et al. (2010), Kingdon and Cassen (2010) or (Strand 2010), who find that black boys especially tend to have lower attainment than their peers; however, children of Black African immigrants constitute a notably different group than black pupils more broadly, which include Black Caribbean children whose grandparents or great-grandparents immigrated to the UK and whose

scores still show negative trends today (Strand, 2015). It is also worth noting that although this paper's multilevel models do show a boost in initial assessment scores for females on the whole, they do not show statistically significant differences between boys' and girls' achievement within ethnic groups of children of immigrants when gender is interacted with these terms (in a separate analysis). The results of this study are more in line with those of Strand et al. (2015), who find that EAL learners catch up to their peers by age 16, or, further afield, van Ours and Veenman (2006), who account for disparities in the Netherlands by controlling for parental education. Unlike most of these studies, the present study looks at white children of immigrants as a distinct group, finding that they achieve well on assessments in both cohorts. With numbers of white immigrants from eastern Europe in the UK increasing faster than any other group (ONS 2016; Rienzo & Vargas-Silva 2017), focusing on white immigrants specifically becomes all the more topical.

Socioeconomic, linguistic, cultural and discriminatory factors have all been invoked to explain achievement gaps that have been documented in the UK. The full OLS and multilevel models show significant coefficients for measures of family socioeconomic status, giving credence to this theoretical explanation. In the BCS70 OLS Model C, for example, family income of less than £100 per week is associated with lower reading and maths scores. In the MCS, multiple categories of income quintile, parental education (NVQ), and parental occupation (NS-SEC) have significant effects on initial status. In addition, MCS members with a multilingual or non-English home score lower on age-3 verbal assessments but improve more quickly than children who speak only English at home, whereas analogous coefficients for quantitative scores are not significant. This gives some support to

linguistic factors in explaining achieving gaps, although similar measures of home language environment in the BCS70 are not significant in the full OLS models.

Cultural differences besides language ability may contribute to explaining disparities, but are difficult to quantify. The gap in verbal scores in both cohorts, even when controlling for home language environment, may have parallels with Brooker's (2015) work in British Early Childhood Education and 'best parenting practices' that favour the dominant British culture and skills that parents from this background teach their young children. In the BCS70, the low scores of Caribbean pupils may reflect Ogbu's (1992) oppositional 'secondary' cultural differences that oppressed groups ('involuntary minorities') develop against their oppressors and manifest in the education system, as documented in the UK by Sewell (1997) and Gillborn (2008). In the MCS, however, such gaps in later assessments are not present after controls are introduced. This paper does not claim that racism is no longer a problem — for one, the sample did not contain Black Caribbean children, who may experience higher levels of discrimination than other pupils of colour (Strand, 2015) — but it does come to the upbeat conclusion that minority ethnic children of immigrants in the MCS do not differ in achievement from their peers when controls are applied.

This paper presents a generally positive report card for education of children of immigrants over the past 30 years. Compared to the BCS70, raw scores in the MCS show much more equality, especially in later assessments, although the disparity in predicted MCS verbal scores at age 3 leaves cause for concern. Overall, the educational situation for children of immigrants since 1980 seems to have changed for the better. Although it is difficult to locate exact determinants of these changes, and many factors outside the classroom are surely in play, possible factors in education policy might include the Education Reform Act of 1988, the expansion of

Section 11 funding in 1993 from EAL learners to all minority ethnic pupils at risk of underachieving, and Labour's introduction of the Ethnic Minority Achievement Grant (EMAG) in 1998 and this funding source's 12-year lifespan (Tikly et al. 2005), including many of the Millennium Cohort's school years. In addition, children of immigrants born in the year 2000 constitute a very different group from their counterparts 30 years earlier, with numerous changes in immigration policy in the intervening years (Anwar, 1995). It is also important to keep in mind that equality in the classroom does not necessarily translate to equality in the labour market or freedom from racism and xenophobia. Furthermore, at risk of unwise speculation, these trends in education may not continue, following recent changes to education policy, including mainstreaming of EMAG (Bates 2012; Wright 2013).

Further research into this topic could rely on assessments that are more consistent and comparable than those administered in these cohort studies, such as Key Stage tests. Key Stage 1 and 2 linked data are already available for the MCS, and GCSE scores should be available when the next survey is released (planned to be conducted in 2018, likely released in 2020). Future quantitative studies could examine larger samples of children of Caribbean immigrants today and compare their academic outcomes to their counterparts' in the 1970s and '80s. Researchers could also look at the grandchildren of immigrants to see if later generations continue to do well, or at the children of immigrants in other countries, comparing their assessment trajectories to those in the UK. In-depth qualitative investigations could elucidate which theoretical explanations are the most convincing in explaining achievement patterns, possibly looking at high-achieving white or Indian children of immigrants and comparing them to other children of immigrants who do not excel to the same extent. Studies in the future can also verify if the educational situation of

children of immigrants in the UK continues to show positive trends in the wake of policy changes by the recent Conservative-controlled governments.

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