Understanding the Early Origins of the Education-Health Gradient - A Framework That Can Also Be Applied to Analyze Gene-Environment Interactions

Gabriella Conti

University of Chicago

James J. Heckman

University of Chicago

and University College Dublin

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Web Appendix

A   Measurement System

As indicators of cognitive ability we use the following seven test scores administered to the children at age ten:

- the Picture Language Comprehension Test: this is a new test specifically developed for the BCS70 on the basis of the American Peabody Picture Vocabulary Test and the English Picture Vocabulary Test; it covers vocabulary, sequence and sentence comprehension.

- the Friendly Math Test: this is a new test specifically designed for the BCS70; it covers arithmetic, fractions, algebra, geometry and statistics.

- the Shortened Edinburgh Reading Test: this is a shortened version of the Edinburgh Reading Test, which is a test of word recognition particularly designed to capture poor readers; it covers vocabulary, syntax, sequencing, comprehension, and retention.

- the four British Ability Scales: they measure a construct similar to IQ, and include two verbal scales (Word Definition and Word Similarities) and two non-verbal scales (Recall Digits and Matrices).

We performed a preliminary factor analysis of these measurements. Both Velicer (1976) minimum average partial correlation criterion and Kaiser (1960) eigenvalue rule suggested to retain one component.

As measurements of noncognitive ability we use six scales collected at age ten:

- the locus of control (caraloc) scale: this is administered to the child and includes sixteen items which measure whether an individual's locus of control is external or internal;

- a perseverance scale: this is administered to the teacher, who answers to the question "How much perseverance does the child show in face of difficult tasks?" on a scale from 1 to 47;

- a cooperativeness scale: this is administered to the teacher, who makes an estimate of how cooperative is the child with his peers, on a scale from 1 to 47;

- a completeness scale: this is administered to the teacher, who assesses "The child completes tasks which are started", on a scale from 1 to 47;

- an attentiveness scale: this is administered to the teacher, who assesses "Child pays attention to what is being explained in class", on a scale from 1 to 47;

- a persistence scale: this is administered to the teacher, who assesses "Child shows perseverance, persists with difficult or routine work", on a scale from 1 to 47.

We performed a preliminary factor analysis of these measurements. Both Velicer (1976) minimum average partial correlation criterion and Kaiser (1960) eigenvalue rule suggested to retain one component. The Cronbach's alpha reliability coefficient for this scale is 0.81.
Finally, we use the following measures for the health endowment, recorded at age ten:

- height (recorded during the medical visit);

- head circumference (recorded during the medical visit);

- father's height;

- mother's height.

We performed a preliminary factor analysis of these measurements. Both Velicer (1976) minimum average partial correlation criterion and Kaiser (1960) eigenvalue rule suggested to retain one component.

Table A.1: Summary Statistics: Outcomes

| | Males | | | | | | | | | | Females | | | | | | | | | |
| | Compulsory 0.60 | | | | | Post-Compulsory 0.40 | | | | | Compulsory 0.50 | | | | | Post-Compulsory 0.50 | | | | |
	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n
Daily Smoking	0.38	0.48	0	1	1585	0.19	0.39	0	1	1069	0.37	0.48	0	1	1431	0.17	0.37	0	1	1428
Poor Health	0.17	0.38	0	1	1587	0.11	0.31	0	1	1071	0.18	0.38	0	1	1431	0.10	0.29	0	1	1429
Obesity	0.13	0.33	0	1	1560	0.09	0.29	0	1	1048	0.35	0.48	0	1	1383	0.29	0.45	0	1	1390

Source: Conti et al. (2010a,b)

Table A.2: Summary Statistics: Measurements

	Males					Females				
	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n
Cognitive Scores (Age 10)										
Picture Language Comprehension Test	41.83	7.29	18	71	3769	40.30	7.15	17	71	3614
Friendly Math Test	45.20	12.48	1	72	3770	43.98	11.23	4	72	3614
Shortened Edinburgh Reading Test	45.10	15.55	1	74	3772	47.36	14.46	0	74	3618
BAS Matrices	15.35	5.39	0	28	3777	15.88	5.24	1	28	3620
BAS Recall Digits	22.34	4.31	1	34	3763	22.62	4.22	8	34	3608
BAS Similarities	12.38	2.60	0	20	3746	12.00	2.42	0	20	3601
BAS Word Definition	10.89	5.19	0	30	3760	9.86	4.74	0	29	3611
Noncognitive Scales (Age 10)										
Locus of control	9.87	2.45	1.5	16	3477	9.66	2.38	1.5	16	3346
Perseverance	27.04	11.60	1	47	3777	30.08	10.80	1	47	3620
Cooperativeness	31.39	9.05	1	47	3748	32.33	8.818	1	47	3586
Completeness	30.98	13.72	1	47	3749	35.33	12.41	1	47	3596
Attentiveness	30.27	12.92	1	47	3752	33.87	12.16	1	47	3581
Persistence	25.84	13.78	1	47	3754	30.22	12.96	1	47	3607
Health Measurements (Age 10)										
Height (cms)	1.39	0.06	1.18	1.61	3777	1.38	0.06	1.17	1.63	3620
Head circumference (mms)	539.36	17.87	318	597	3690	530.64	18.05	305	597	3501
Mother height (cms)	161.15	6.56	124	183	3774	161.51	6.65	132	188	3618
Father height (cms)	175.28	7.49	147	211	3622	149.55	62.68	0	201	3616

BAS = British Ability Scales.

Source: Conti et al. (2010a,b)

Note: The table displays the unstandardized measurements. Note all measurements have been standardized for the purpose of estimation.

Table A.3: Summary Statistics: Covariates

	Males					Females				
	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n
Covariates										
Mother's age at birth	25.84	5.31	14	52	3777	25.78	5.28	15	46	3620
Mother's education a birth	0.33	0.47	0	1	3777	0.34	0.47	0	1	3620
# Children at age 10	2.55	1.03	1	13	3777	2.54	1.03	1	10	3620
Father high SC at birth	0.29	0.45	0	1	3777	0.29	0.45	0	1	3620
Broken family	0.12	0.32	0	1	3777	0.13	0.34	0	1	3620
Total gross family income at age 10[1]	4.03	1.23	1	7	3777	4.06	1.25	1	7	3620
Parity	1.12	1.27	0	11	3777	1.11	1.29	0	10	3620
Additional Covariates in the Measurement System										
Weight[2] (kgs)	32.24	4.90	23	48	3777	32.80	5.62	23	51	3620
Mother weight[2] (kgs)	60.82	10.34	35	164	3777	61.03	10.60	29	132	3620
Father weight[2] (kgs)	75.14	10.16	41	167	3777	75.34	9.89	44	139	3620
Additional Covariate in the Schooling Choice Equation										
Claimant Count	12.89	3.42	7.8	19.8	3777	7.77	1.48	5.2	10.1	3620

Table A.4: Measurement System: Cognitive Factor – Males

	Picture Language Comprehension Test	Friendly Math Test	Shortened Edinburgh Reading Test	BAS Matrices	BAS Recall Digits	BAS Similarities	BAS Word Definition
Constant	-0.516 (0.113)	-0.814 (0.120)	-0.803 (0.118)	-0.840 (0.122)	-0.699 (0.126)	-0.647 (0.122)	-0.776 (0.117)
Father high SC at birth	0.284 (0.036)	0.364 (0.037)	0.304 (0.037)	0.222 (0.038)	0.140 (0.039)	0.303 (0.039)	0.379 (0.038)
Income	0.056 (0.013)	0.085 (0.014)	0.082 (0.013)	0.071 (0.014)	0.034 (0.014)	0.078 (0.014)	0.073 (0.013)
Broken Family	-0.117 (0.048)	-0.104 (0.048)	-0.069 (0.047)	-0.048 (0.049)	-0.021 (0.051)	-0.071 (0.049)	-0.063 (0.048)
Mother's Age	0.226 (0.035)	0.197 (0.038)	0.178 (0.036)	0.166 (0.037)	0.187 (0.039)	0.185 (0.038)	0.269 (0.037)
Mother stayed in school beyond MSLA	0.299 (0.034)	0.354 (0.035)	0.367 (0.035)	0.328 (0.036)	0.143 (0.037)	0.311 (0.035)	0.343 (0.036)
Parity	-0.083 (0.017)	-0.107 (0.017)	-0.113 (0.016)	-0.084 (0.017)	-0.046 (0.018)	-0.090 (0.017)	-0.111 (0.017)
Number of children	-0.108 (0.017)	-0.028 (0.018)	-0.053 (0.017)	0.002 (0.017)	0.001 (0.018)	-0.065 (0.018)	-0.082 (0.017)
Cognitive Factor	0.820 (0.028)	1.273 (0.030)	1.265 (0.030)	1.000 (0.000)	0.717 (0.029)	1.028 (0.029)	1.074 (0.030)
Noncognitive Factor	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Health Factor	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Precision	1.735 (0.043)	3.562 (0.117)	3.889 (0.123)	1.920 (0.049)	1.254 (0.030)	1.990 (0.052)	2.182 (0.058)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age. BAS: British Ability Scale.

Table A.5: Measurement System: NonCognitive Factor – Males

	Locus of control Scale	Perseverance Scale	Cooperativeness Scale	Completeness Scale	Attentiveness Scale	Persistance Scale
Constant	-0.504	-0.647	-0.253	-0.524	-0.774	-0.644
	(0.125)	(0.113)	(0.121)	(0.116)	(0.114)	(0.115)
Father high SC at birth	0.226	0.179	0.045	0.131	0.082	0.126
	(0.040)	(0.037)	(0.039)	(0.037)	(0.037)	(0.036)
Income	0.047	0.037	0.037	0.035	0.048	0.023
	(0.014)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)
Broken Family	-0.079	-0.153	-0.150	-0.131	-0.074	-0.105
	(0.052)	(0.046)	(0.050)	(0.048)	(0.047)	(0.046)
Mother's Age	0.167	0.119	0.034	0.068	0.161	0.115
	(0.039)	(0.035)	(0.037)	(0.037)	(0.036)	(0.036)
Mother stayed in school beyond MSLA	0.276	0.190	0.060	0.130	0.147	0.179
	(0.038)	(0.035)	(0.037)	(0.036)	(0.035)	(0.034)
Parity	-0.077	-0.067	-0.013	-0.046	-0.092	-0.067
	(0.018)	(0.017)	(0.018)	(0.017)	(0.017)	(0.017)
Number of children	-0.061	-0.012	-0.024	-0.010	0.004	0.005
	(0.019)	(0.016)	(0.018)	(0.017)	(0.017)	(0.017)
Cognitive Factor	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Noncognitive Factor	0.423	1.000	0.565	0.880	0.917	0.993
	(0.019)	(0.000)	(0.019)	(0.017)	(0.017)	(0.016)
Health Factor	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Precision	1.258	3.830	1.313	2.176	2.674	3.651
	(0.030)	(0.133)	(0.032)	(0.058)	(0.078)	(0.128)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age.

Table A.6: Measurement System: Health Factor – Males

	Height	Head Circumference	Mother's Height	Father's Height
Constant	-0.272	-0.304	-0.419	-0.410
	(0.086)	(0.111)	(0.085)	(0.053)
Father high SC at birth	0.050	0.055	-	0.279
	(0.026)	(0.035)	(-)	(0.033)
Income	0.027	0.060	0.084	0.079
	(0.010)	(0.013)	(0.013)	(0.013)
Broken Family	-0.068	0.032	-	-
	(0.035)	(0.046)	(-)	(-)
Mother's age	0.070	0.090	-0.010	-
	(0.027)	(0.034)	(0.027)	(-)
Mother stayed in school beyond MSLA	0.072	0.089	0.245	-
	(0.026)	(0.033)	(0.031)	(-)
Parity	-0.037	-0.007	-	-
	(0.012)	(0.016)	(-)	(-)
Number of children	0.016	0.016	-	-
	(0.012)	(0.016)	(-)	(-)
Weight	0.609	0.369	0.352	0.422
	(0.012)	(0.015)	(0.014)	(0.015)
Cognitive Factor	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Noncognitive Factor	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Health Factor	1.000	0.232	0.965	0.777
	(0.000)	(0.042)	(0.065)	(0.057)
Precision	3.672	1.363	1.639	1.539
	(0.225)	(0.032)	(0.053)	(0.043)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age.

Table A.7: Measurement System: Cognitive Factor – Females

	Picture Language Comprehension Test	Friendly Math Test	Shortened Edinburgh Reading Test	BAS Matrices	BAS Recall Digits	BAS Similarities	BAS Word Definition
Constant	-0.594	-0.726	-0.634	-0.635	-0.507	-0.821	-0.908
	(0.120)	(0.113)	(0.112)	(0.122)	(0.129)	(0.115)	(0.114)
Father high SC at birth	0.254	0.287	0.265	0.192	0.138	0.215	0.276
	(0.037)	(0.035)	(0.036)	(0.038)	(0.041)	(0.036)	(0.035)
Income	0.082	0.098	0.097	0.089	0.050	0.100	0.096
	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)
Broken Family	-0.138	-0.125	-0.097	-0.104	-0.006	-0.104	-0.084
	(0.045)	(0.045)	(0.045)	(0.047)	(0.049)	(0.045)	(0.045)
Mother's Age	0.138	0.111	0.164	0.109	0.080	0.171	0.204
	(0.038)	(0.035)	(0.035)	(0.039)	(0.041)	(0.036)	(0.035)
Mother stayed in school beyond MSLA	0.238	0.278	0.343	0.254	0.220	0.314	0.349
	(0.034)	(0.034)	(0.033)	(0.036)	(0.037)	(0.034)	(0.033)
Parity	-0.073	-0.051	-0.086	-0.067	-0.003	-0.078	-0.088
	(0.017)	(0.016)	(0.016)	(0.018)	(0.018)	(0.017)	(0.016)
Number of children	-0.099	-0.035	-0.069	0.003	0.009	-0.066	-0.075
	(0.017)	(0.017)	(0.017)	(0.019)	(0.019)	(0.017)	(0.017)
Cognitive Factor	0.819	1.185	1.210	1.000	0.730	0.999	1.010
	(0.029)	(0.030)	(0.031)	(0.000)	(0.030)	(0.031)	(0.030)
Noncognitive Factor	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Health Factor	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Precision	1.713	3.763	4.244	1.918	1.311	2.299	2.527
	(0.043)	(0.119)	(0.141)	(0.050)	(0.031)	(0.062)	(0.069)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age. BAS: British Ability Scale.

Table A.8: Measurement System: NonCognitive Factor – Females

	Locus of control Scale	Perseverance Scale	Cooperativeness Scale	Completeness Scale	Attentiveness Scale	Persistance Scale
Constant	-0.761	-0.283	0.044	-0.224	-0.220	-0.146
	(0.125)	(0.121)	(0.128)	(0.123)	(0.122)	(0.123)
Father high SC at birth	0.275	0.208	0.148	0.136	0.148	0.172
	(0.039)	(0.038)	(0.040)	(0.037)	(0.037)	(0.038)
Income	0.114	0.045	0.016	0.067	0.036	0.037
	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)
Broken Family	-0.096	-0.201	-0.189	-0.142	-0.224	-0.168
	(0.049)	(0.045)	(0.050)	(0.043)	(0.045)	(0.046)
Mother's Age	0.133	0.118	0.002	0.052	0.110	0.076
	(0.040)	(0.038)	(0.041)	(0.039)	(0.038)	(0.038)
Mother stayed in school beyond MSLA	0.224	0.093	0.033	0.069	0.113	0.107
	(0.037)	(0.035)	(0.037)	(0.035)	(0.035)	(0.037)
Parity	-0.040	-0.066	-0.014	-0.048	-0.064	-0.047
	(0.018)	(0.017)	(0.018)	(0.017)	(0.017)	(0.017)
Number of children	-0.074	-0.031	-0.029	-0.011	-0.024	-0.030
	(0.019)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)
Cognitive Factor	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Noncognitive Factor	0.420	1.000	0.574	0.808	0.945	0.979
	(0.022)	(0.000)	(0.022)	(0.019)	(0.019)	(0.018)
Health Factor	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Precision	1.340	3.780	1.345	2.238	2.893	3.215
	(0.034)	(0.130)	(0.033)	(0.060)	(0.089)	(0.105)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age.

Table A.9: Measurement System: Health Factor – Females

	Height	Head Circumference	Mother's Height	Father's Height
Constant	-0.318	-0.408	-0.346	-0.455
	(0.088)	(0.119)	(0.088)	(0.053)
Father high SC at birth	0.049	0.096	-	0.196
	(0.028)	(0.035)	(-)	(0.034)
Income	0.032	0.030	0.076	0.101
	(0.011)	(0.013)	(0.013)	(0.013)
Broken Family	-0.050	-0.126	-	-
	(0.034)	(0.045)	(-)	(-)
Mother's age	0.049	0.007	-0.013	-
	(0.028)	(0.038)	(0.029)	(-)
Mother stayed in school beyond MSLA	0.072	0.025	0.257	-
	(0.027)	(0.034)	(0.029)	(-)
Parity	-0.021	0.002	-	-
	(0.013)	(0.017)	(-)	(-)
Number of children	0.004	0.000	-	-
	(0.013)	(0.017)	(-)	(-)
Weight	0.580	0.334	0.360	0.441
	(0.011)	(0.014)	(0.015)	(0.016)
Cognitive Factor	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Noncognitive Factor	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Health Factor	1.000	0.293	0.848	0.694
	(0.000)	(0.046)	(0.064)	(0.057)
Precision	3.369	1.339	1.482	1.561
	(0.223)	(0.032)	(0.045)	(0.046)

Note: Numbers in parentheses are standard errors. SC: social class. MSLA: minimum school-leaving age.

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