Does intelligence shield children from the effects of parental unemployment?

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Motivation

Parental job loss has negative impact on children's outcomes

- **education** Coelli (2011); Rege, Telle, and Votruba (2011)
- **earnings and employment** Oreopoulos, Page, and Stevens (2008)
- **personality and well-being** Angelini, Bertoni, and Corazzini (2018); Brand and Thomas (2014)

Potential mechanisms

- **loss of income** Coelli (2011); Oreopoulos, Page, and Stevens (2008)
- **psychological distress** Rege, Telle, and Votruba (2011)
- **change in preferences** Taylor and Rampino (2014)

Different interactions with cognitive skills of children

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Different interactions with cognitive skills of children

Research question

How do these effects vary with intelligence?

- UK largest household survey

- Parental unemployment at age 14

- Interaction with IQ score of respondents

- Causal interpretation in difference-in-differences framework

Preview of results

- Higher IQ worsens the effect of parental unemployment on **education**

  - Most of the losses among children of less-educated parents
  - Dynamic complementary of skills (Cunha and Heckman 2007)

- Higher IQ mitigates some of the effects later in the **labour market**

  - More stable and prestigious jobs; higher earnings
  - Wage penalty remains
  - Employer-learning theory (Farber and Gibbons 1996)

- Support income loss channel

- Suggestive evidence that institutional environment matters

Data

Cross-sectional: wave 3 (2011-13)

- *Main variables*:

  - six cognitive test results PCA
  - employment status of parents when respondents were 14
    Aggregate Detailed

- *Education*: post-16 school, tertiary degree, university degree, years of schooling

- *Labour market*: empl status, earnings, hours worked, hourly wages, job ranking

Difference-in-differences

$$Y_i = \beta_0 + \beta_1 UP_i + \beta_2 IQ_i + \boldsymbol{\beta_3} UP_i \times IQ_i + \beta_4 \mathbf{X}_i + \beta_5 \mathbf{P}_i + v_i$$

Y_i outcome

UP_i 1 if parent unemployed when child was 14

IQ_i child's intelligence score

$\mathbf{X}_i$ child's pre-determined characteristics *(gender, birth year & country, ethnicity, immigrant)*

$\mathbf{P}_i$ parents' pre-determined characteristics *(highest qual, country of birth)*

Causal interpretation

Potential outcomes: Y^0 when parents are employed; Y^1 when parents are unemployed

Parallel trends: constant selection bias across intelligence ⬤ Graph

$$\frac{\text{Cov}(Y^0, IQ|UP = 1)}{\text{Var}(IQ|UP = 1)} - \frac{\text{Cov}(Y^0, IQ|UP = 0)}{\text{Var}(IQ|UP = 0)} = 0$$

UKHLS birth · BCS birth · IQ persistence · BCS age 5 · BCS age 16 · IQ as outcome

$$\beta_3 = \frac{\partial}{\partial IQ} \mathbb{E}(Y^1 - Y^0|UP = 1, IQ)$$

How intelligence chanages the effect of parental unemployment

Results

Education

	Dependent variables			
	Age left school	Post-16 school	Degree	Uni degree
Parent unemp	-0.174***	-0.085***	-0.039***	-0.028**
	(0.023)	(0.013)	(0.012)	(0.012)
IQ	0.288***	0.137***	0.131***	0.095***
	(0.007)	(0.004)	(0.003)	(0.006)
Parent unemp × IQ	-0.096†††	-0.041†††	-0.036†††	-0.033†††
	(0.020)	(0.011)	(0.010)	(0.010)
Obs.	20,202	20,202	20,202	20,202

† $q<0.1$; †† $q<0.05$; ††† $q<0.01$ based on FDR q-values

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ based on conventional p-values

Dynamic complementarity (Cunha and Heckman 2007)

Loss of HC investments has larger effect on high-skilled children

Intergenerational transmission of earnings (Mulligan 1997)

Only poor households $\downarrow$ HC investments in response to income shocks

- Strongest effects among individuals with less-educated parents Table

Labour market

	Dependent variables			
	Work	%Δ earnings	%Δ hourly wage	Hours
Parent unemp	-0.063***	-24.760***	-11.305***	-2.787***
	(0.012)	(3.385)	(2.483)	(0.489)
IQ	0.053***	29.807***	16.860***	1.896***
	(0.004)	(1.303)	(0.879)	(0.143)
Parent unemp $\times$ IQ	0.047†††	9.717†††	-4.492	1.560†††
	(0.012)	(3.079)	(2.444)	(0.439)
Obs.	20,202	20,202	15,589	20,202

$^{\dagger}q<0.1$; $^{\dagger\dagger}q<0.05$; $^{\dagger\dagger\dagger}q<0.01$ based on FDR q-values

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$ based on conventional p-values

Heckman two-step

Employer learning theory (Farber and Gibbons 1996)

- Initially, education is the main signal of worker ability Job rankings

- Over time, receive additional signals about worker productivity Age profiles

Conclusion

- New: how intelligence changes parental unemployment effects on children

- Higher IQ exacerbates costs on educational attainment
    - born by children of less educated parents

- Higher IQ mitigates some labour-market outcomes later in life
    - consistent with employer-learning theory (Farber and Gibbons 1996)

- Loss of human capital investments as the driving mechanism

Thank you!

Appendix

Loss of human capital investments is main channel

Loss of human capital investments is main channel

- Parents' gender: severity of income loss `Table` `Benefits`

- Children's gender: personality traits `Table`

- Institutional environment `Table`

Robustness checks

- UKHLS subsamples `Table`

  - Cohorts born before 1981 `Recall bias`

  - Ethnically white British

  - Separate regressions by birth countries (England, Scotland, Wales and NI)

- Replication in the BCS70 `Table`
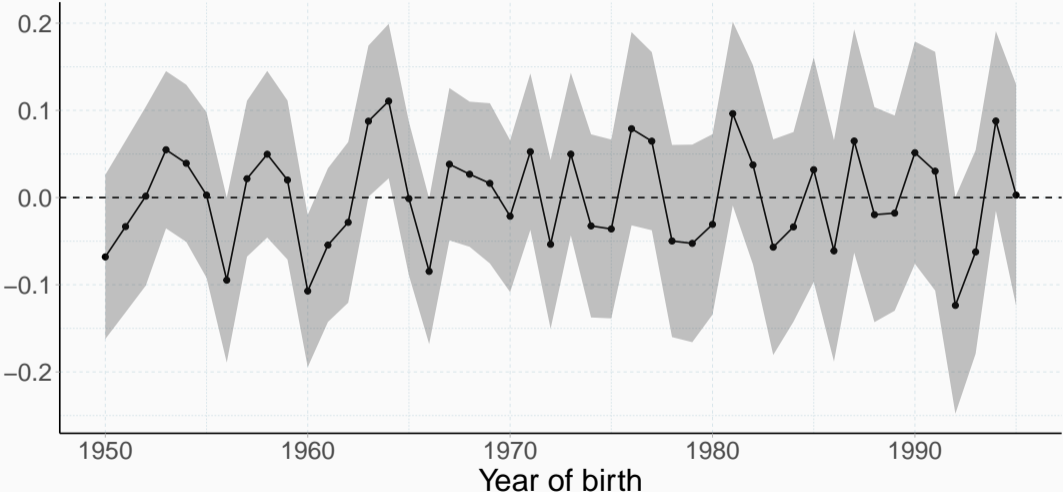
Intelligence score: principal component analysis

- 5 tests administered in wave 3 to all 16+ respondents

- Use PC1 as the intelligence score (42.2% of variation)

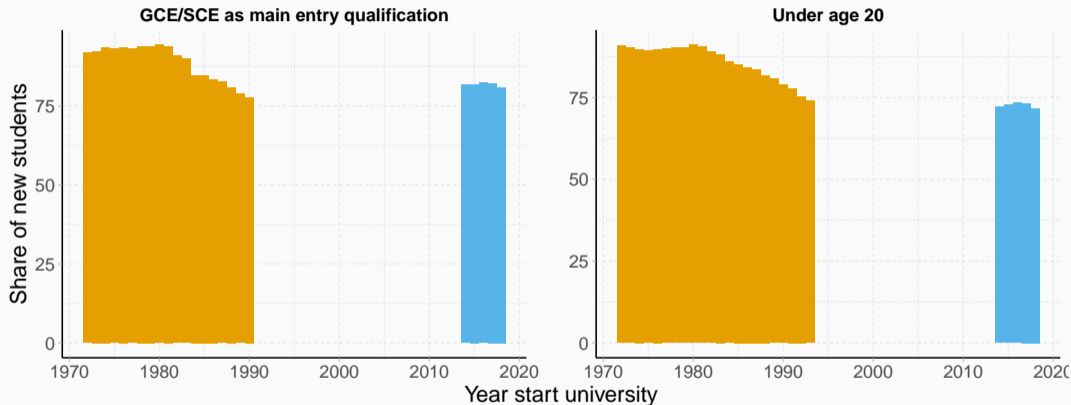| Test	Measure	PC1 loading
Immediate word recall	Episodic memory	0.46
Delayed word recall	Episodic memory	0.45
Serial 7 subtraction	Working memory	0.32
Number series	Fluid reasoning	0.40
Verbal fluency	Categoric fluency	0.36
Numeric ability	Numerical knowledge	0.44

- Standardize to mean 0 and sd 1 by sex and 5-year birth cohorts

Average intelligence score

University admission in the UK

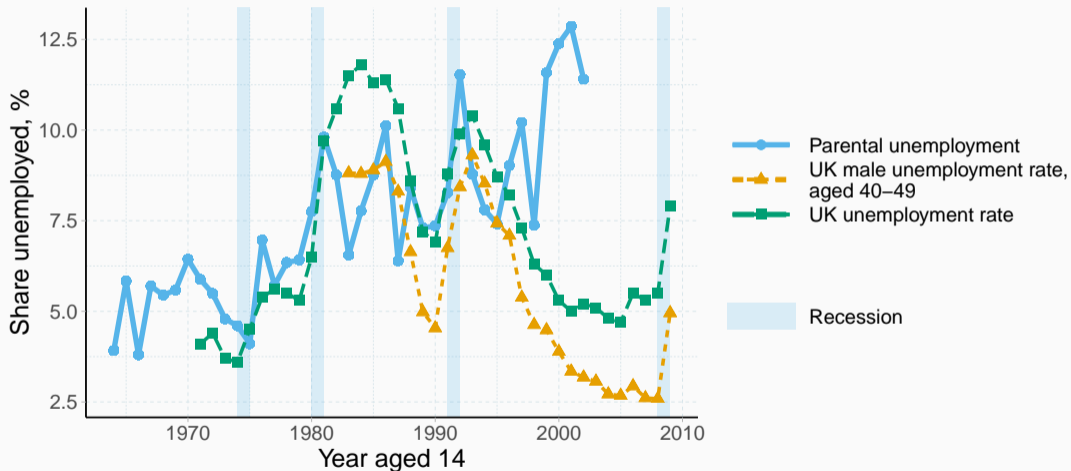**GCE/SCE as main entry qualification** — **Under age 20**
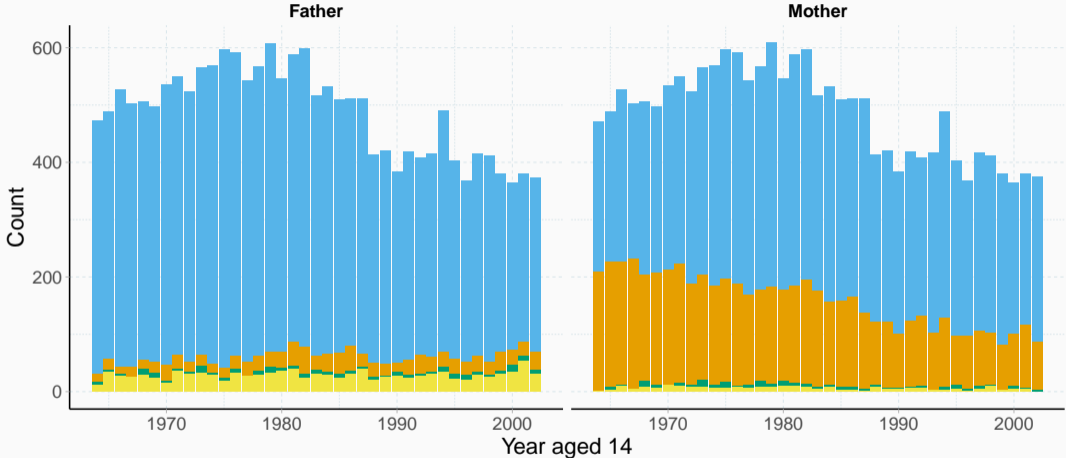
Share of new students vs. Year start university

Data source: Higher Education Statistics Agency (1994–) · Universities' Statistical Record (1972–1993)
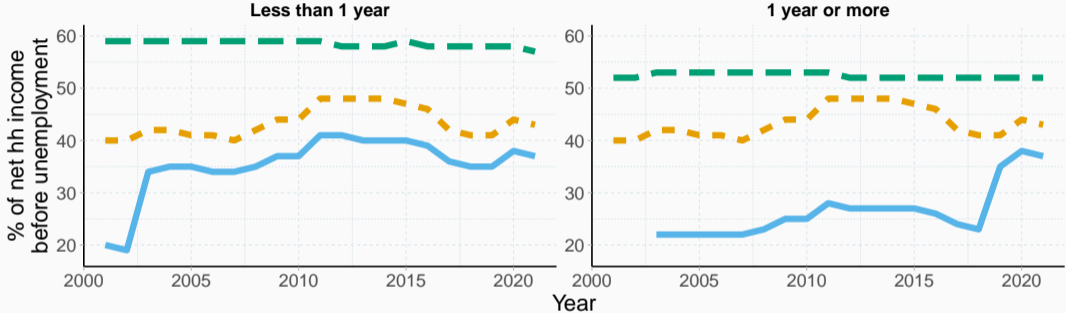
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Parental unemployment (aggregate)

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Parental unemployment (detailed)

Unemployment benefits

Net household income during unemployment

Less than 1 year

1 year or more

% of net hh income before unemployment

Year

Single person with 2 children

Couple with 2 children – partner is out of work

Couple with 2 children – partner's earnings: AW

Source: OECD

Relative stability of intelligence score (BCS70)
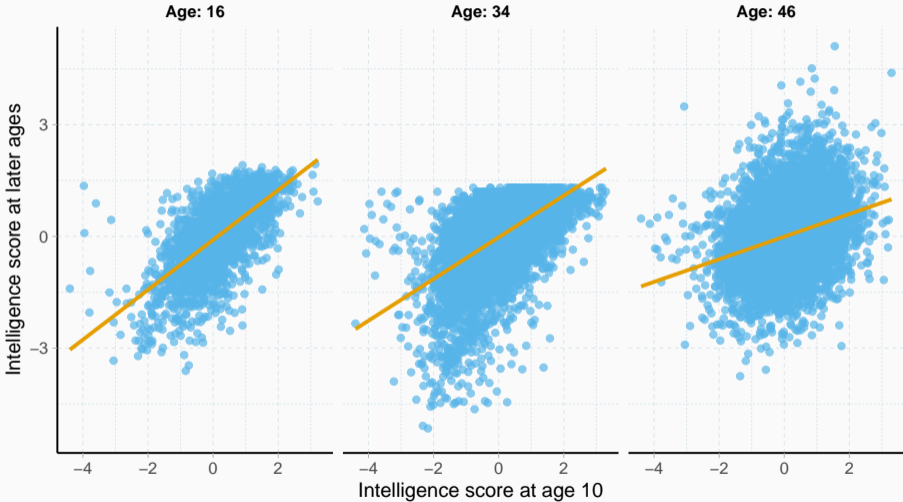
Parental unemployment and gap in outcomes

Figure with four panels showing Gap relative to employed parents by Intelligence score tercile (bottom, middle, top): Degree, Hours worked, Inverse hyperbolic sine (IHS) earn, Current job rank.
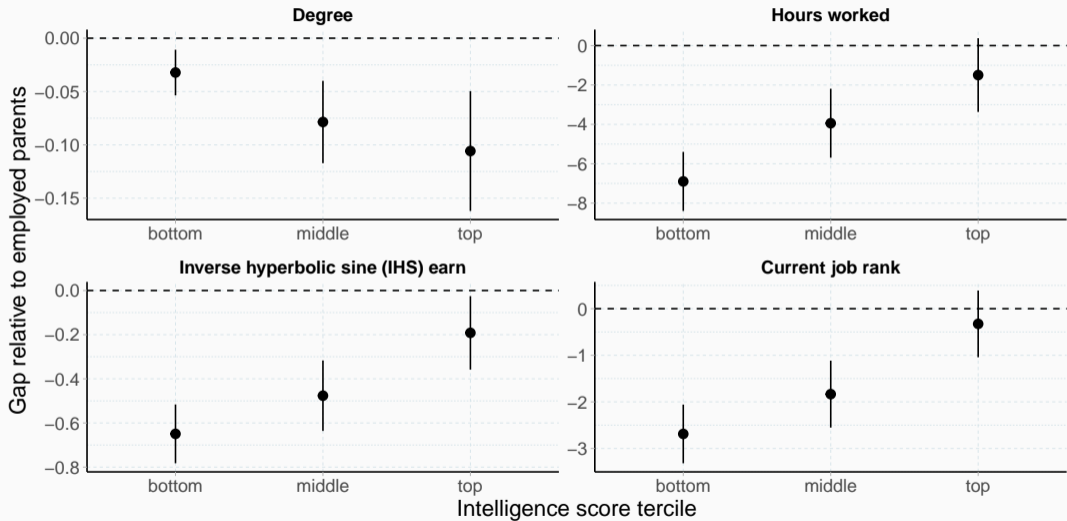
Parallel trends

Potential outcomes
- Y^0 when parents stay employed
- Y^1 when parents are unemployed

Parental unemployment
- $UP = 0$ stay employed
- $UP = 1$ unemployed

Parallel trends requires

$$\frac{\mathsf{Cov}(Y^0, IQ | UP = 1)}{\mathsf{Var}(IQ | UP = 1)} - \frac{\mathsf{Cov}(Y^0, IQ | UP = 0)}{\mathsf{Var}(IQ | UP = 0)} = 0$$

Selection bias flat across intelligence score of children

Parallel trends (graphical)

Potential outcomes
- Y^0 when parents stay employed
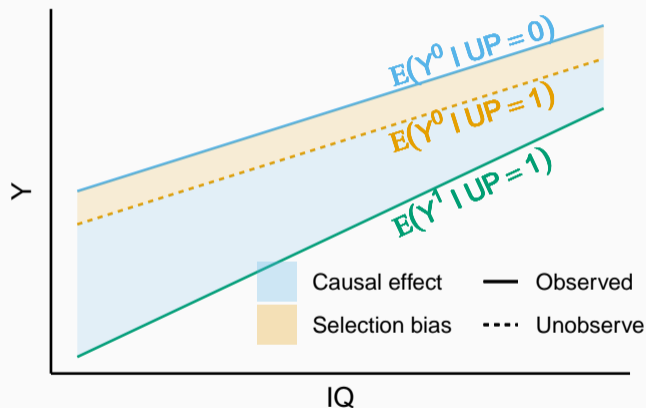- Y^1 when parents are unemployed

Parental unemployment
- $UP = 0$ stay employed
- $UP = 1$ unemployed

Characteristics at birth in the UKHLS

| | Regressors | | | | |
Dependent variable	Parent unemp	IQ	Parent unemp × IQ	Obs.	Mean outcome
Father's mother born UK	20,202	-0.002	0.002	-0.007	0.759
	(NA)	(0.002)	(0.006)	(0.007)	(NA)
Father's father born UK	20,202	0.002	0.006	-0.011	0.750
	(NA)	(0.002)	(0.006)	(0.007)	(NA)
Mother's mother born UK	20,202	0.001	-0.003	-0.001	0.773
	(NA)	(0.002)	(0.006)	(0.006)	(NA)
Mother's father born UK	20,202	0.005***	0.000	-0.009	0.762
	(NA)	(0.002)	(0.007)	(0.007)	(NA)
Has siblings	20,202	-0.000	-0.006	0.004	0.900
	(NA)	(0.003)	(0.008)	(0.009)	(NA)
White british father	20,202	-0.000	-0.008	0.010	0.674
	(NA)	(0.003)	(0.009)	(0.010)	(NA)
White british mother	20,202	-0.003	-0.005	0.015	0.680
	(NA)	(0.003)	(0.010)	(0.010)	(NA)

Characteristics at birth in the BCS70

Dependent variable	Parent unemp	IQ	Parent unemp × IQ	Obs.	Mean outcome
		Regressors			
Parity	0.444***	-0.069***	0.024	5,063	1.50
	(0.094)	(0.022)	(0.085)		
Lactation attempted	-0.049**	0.031***	-0.026	5,063	0.32
	(0.024)	(0.008)	(0.024)		
Birthweight, g	-60.310*	57.119***	-10.030	5,059	3,284
	(35.011)	(9.956)	(30.745)		
Age of mother	0.575*	0.378***	0.380	5,063	26.18
	(0.325)	(0.082)	(0.307)		
Age of father	1.807***	0.440***	0.760	4,405	29.02
	(0.424)	(0.102)	(0.375)		
Height of mother, cm	-1.131***	0.346***	-0.033	5,029	161
	(0.369)	(0.109)	(0.326)		
Age of mother at first birth	-0.621***	0.485***	0.013	5,043	21.69
	(0.217)	(0.061)	(0.204)		

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Parallel trends and intergenerational persistence of intelligence

Parallel trends condition

−0.2 −0.1 0.0 0.1 0.2
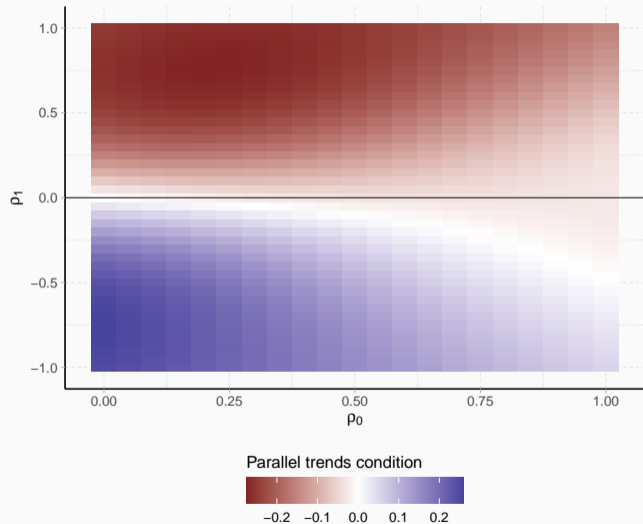
Intergenerational process on IQ

$$IQ_{\mathsf{child}} = \rho(IQ_{\mathsf{par}})IQ_{\mathsf{par}} + \nu$$
$$\rho(IQ_{\mathsf{par}}) = \rho_0 + \rho_1 IQ_{\mathsf{par}}$$

Parallel trends condition

$$\frac{\mathsf{Cov}(IQ_P, IQ_C|UP = 1)}{\mathsf{Var}(IQ_C|UP = 1)} -$$
$$- \frac{\mathsf{Cov}(IQ_P, IQ_C|UP = 0)}{\mathsf{Var}(IQ_C|UP = 0)} = 0$$

Cognitive test results at age 5 in the BCS70

Dependent variable	Parent unemp	IQ	Parent unemp × IQ	Obs.	Mean outcome
		Regressors			
Composite score (PC1)	-0.123	0.267***	0.020	2,134	-0.05
	(0.088)	(0.037)	(0.072)		
Reading score	-0.523	1.448***	-0.898	2,215	3.10
	(0.353)	(0.17)	(0.359)		
English picture vocab. score	-0.349***	0.375***	0.012	4,587	-0.34
	(0.091)	(0.025)	(0.084)		
Copying designs score	-0.052	0.393***	0.089	4,587	-0.10
	(0.062)	(0.017)	(0.056)		
Draw-a-man score	-0.109	0.288***	0.055	4,587	-0.17
	(0.077)	(0.02)	(0.078)		
Complete-a-profile score	-0.330	0.480***	0.016	4,431	6.85
	(0.258)	(0.072)	(0.251)		

Cognitive test results at age 16 in the BCS70

Dependent variable	Regressors			Obs.	Mean outcome
	Parent unemp	IQ	Parent unemp × IQ		
Composite score (PC1)	-0.178*	0.579***	0.129	1,297	-0.07
	(0.1)	(0.026)	(0.103)		
Reading score	-2.791**	7.387***	2.646	1,377	53.58
	(1.368)	(0.351)	(1.459)		
Spelling score	-2.178	14.864***	2.697	5,063	74.11
	(4.753)	(1.365)	(4.205)		
Vocabulary score	-0.872	6.146***	-0.584	5,063	19.64
	(1.284)	(0.381)	(1.162)		
Math score	-0.185	6.102***	0.946	1,643	36.14
	(1.099)	(0.287)	(1.175)		
Complete-matrix score	-0.285*	0.575***	0.034	1,412	8.81
	(0.172)	(0.048)	(0.212)		

Intelligence as outcome

Parallel trend assumption

$$\frac{\mathsf{Cov}(Y^0, IQ^1|UP=1)}{\mathsf{Var}(IQ^1|UP=1)} - \frac{\mathsf{Cov}(Y^0, IQ^0|UP=0)}{\mathsf{Var}(IQ^0|UP=0)} = 0$$

Regression interpretation

$$\beta_3 = \frac{\partial}{\partial IQ^1}\mathbb{E}(Y^1 - Y^0|UP=1, IQ^1)$$

Limitation: $Y^1 - Y^0$ may interact differently with IQ^0

Effect on education by parental qualifications

	Age left school	Post-16 school	Degree	Uni degree
Parent unemp $\times$ IQ	0.067	0.064	0.020	-0.002
	(0.068)	(0.039)	(0.045)	(0.049)
No school $\times$ Parent unemp $\times$ IQ	-0.401[†]	-0.150	-0.257[††]	-0.148
	(0.191)	(0.097)	(0.098)	(0.093)
Some school $\times$ Parent unemp $\times$ IQ	-0.157[†]	-0.104[†]	-0.046	-0.024
	(0.072)	(0.042)	(0.046)	(0.050)
Qual missing $\times$ Parent unemp $\times$ IQ	-0.212[††]	-0.134[††]	-0.098[†]	-0.056
	(0.079)	(0.045)	(0.049)	(0.051)
Obs.	20,202	20,202	20,202	20,202

[†] $q<0.1$; [††] $q<0.05$; [†††] $q<0.01$ based on FDR q-values

[*] $p<0.1$; [**] $p<0.05$; [***] $p<0.01$ based on conventional p-values

Heckman two-step: labour-market results

	Dependent variables			
	IHS earnings	IHS hourly wage	Hours	Current job rank
Parent unemp	-0.264	-0.037	-1.371	-0.091
	(0.061)	(0.009)	(0.434)	(0.016)
IQ	0.283	0.046	0.417	0.132
	(0.034)	(0.005)	(0.255)	(0.008)
Parent unemp $\times$ IQ	0.112	0.009	0.607	0.027
	(0.057)	(0.008)	(0.405)	(0.016)
Obs.	20,202	20,202	20,202	20,202
	(NA)	(NA)	(NA)	(NA)

Job rankings

	Dependent variables	
	First job rank	Current job rank
Parent unemp	-0.041***	-1.049***
	(0.012)	(0.204)
IQ	0.030***	0.888***
	(0.003)	(0.060)
Parent unemp × IQ	0.004	0.881†††
	(0.011)	(0.196)
Obs.	16374.000	20201.000

†$q<0.1$; ††$q<0.05$; †††$q<0.01$ based on FDR q-values

*$p<0.1$; **$p<0.05$; ***$p<0.01$ based on conventional p-values

Age profiles

Child's gender

	Degree	Work	IHS earnings	IHS hourly wage	First job rank	Current job rank
			Dependent variables			
Parent unemp	-0.035*	-0.049***	-0.274***	-0.022***	-0.036*	-0.830***
	(0.018)	(0.018)	(0.066)	(0.005)	(0.019)	(0.299)
IQ	0.132***	0.053***	0.300***	0.029***	0.014***	0.813***
	(0.005)	(0.005)	(0.020)	(0.002)	(0.005)	(0.083)
Parent unemp $\times$ Female	-0.009	-0.027	-0.011	0.009	-0.009	-0.398
	(0.023)	(0.025)	(0.089)	(0.007)	(0.025)	(0.419)
IQ $\times$ Female	-0.001	-0.001	-0.009	-0.008***	0.031***	0.148
	(0.006)	(0.007)	(0.025)	(0.003)	(0.006)	(0.110)
Parent unemp $\times$ IQ	**-0.035**	**0.026**	**0.080**	**-0.014††**	**0.001**	**0.528**
	(0.016)	**(0.019)**	**(0.066)**	**(0.005)**	**(0.017)**	**(0.310)**
Parent unemp $\times$ Female $\times$ IQ	**-0.003**	**0.037**	**0.083**	**0.008**	**0.003**	**0.628**
	(0.020)	**(0.024)**	**(0.084)**	**(0.007)**	**(0.022)**	**(0.403)**

$^\dagger q<0.1$; $^{\dagger\dagger} q<0.05$; $^{\dagger\dagger\dagger} q<0.01$ based on FDR q-values

$^* p<0.1$; $^{**} p<0.05$; $^{***} p<0.01$ based on conventional p-values

Parent's gender

	Dependent variables					
	Degree	Work	IHS earnings	IHS hourly wage	First job rank	Current job rank
IQ	0.134***	0.047***	0.280***	0.025***	0.034***	0.780***
	(0.004)	(0.004)	(0.016)	(0.002)	(0.004)	(0.071)
Father unemp	-0.037**	-0.059***	-0.247***	-0.018***	-0.029**	-0.930***
	(0.015)	(0.015)	(0.054)	(0.003)	(0.014)	(0.247)
Father unemp × IQ	**-0.032**†	**0.037**†	**0.090**	**-0.014**†††	**0.000**	**0.856**†††
	(0.013)	**(0.015)**	**(0.051)**	**(0.004)**	**(0.013)**	**(0.243)**
Mother unemp	0.010	-0.035***	-0.172***	-0.003	-0.021***	-0.597***
	(0.007)	(0.007)	(0.027)	(0.003)	(0.007)	(0.116)
Mother unemp × IQ	**-0.002**	**0.016**	**0.027**	**0.000**	**-0.010**	**0.221**
	(0.007)	**(0.008)**	**(0.027)**	**(0.003)**	**(0.007)**	**(0.119)**

† $q<0.1$; †† $q<0.05$; ††† $q<0.01$ based on FDR q-values

* $p<0.1$; ** $p<0.05$; *** $p<0.01$ based on conventional p-values

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Robustness checks: UKHLS

Parent unemp × IQ

	Baseline	Born < 1981	White British	Born in England	Scotland	Wales	NI
Post-16 school	-0.041†††	-0.030††	-0.040†††	-0.040†††	-0.014	-0.046	-0.043
	(0.011)	(0.014)	(0.012)	(0.013)	(0.039)	(0.031)	(0.033)
Degree	-0.036†††	-0.017	-0.038†††	-0.035†††	0.001	-0.059†	-0.005
	(0.010)	(0.013)	(0.011)	(0.012)	(0.028)	(0.024)	(0.028)
Work	0.047†††	0.049†††	0.052†††	0.054†††	0.044	0.033	-0.094†††
	(0.012)	(0.014)	(0.013)	(0.014)	(0.037)	(0.041)	(0.027)
%Δ earnings	9.717†††	13.915††	14.791†††	15.144†††	10.192	18.500	-27.116††
	(3.079)	(4.932)	(4.412)	(4.589)	(12.480)	(12.799)	(9.577)
%Δ hourly wage	-4.492	-4.116†††	-5.299†††	-4.708†††	-19.523†††	-14.162†††	10.996†††
	(2.444)	(1.312)	(1.132)	(1.288)	(2.145)	(1.706)	(1.482)
Hours	1.560†††	1.379††	1.719†††	1.649†††	2.076	2.720†	-3.444†††
	(0.439)	(0.533)	(0.476)	(0.500)	(1.306)	(1.178)	(1.011)

Robustness checks: BCS70

Depedent variable	UKHLS born in 1970		BCS70 age 26		age 30		age 34		age 38	
	UP × IQ	N	UP × IQ	N	UP × IQ	N	UP × IQ	N	UP × IQ	N
Degree	-0.004	578	-0.072†††	4,901	-0.060†††	5,056	-0.039†	5,063	-0.005	3,555
	(0.013)	578	(0.011)	4,901	(0.016)	5,056	(0.018)	5,063	(0.026)	3,555
Work	0.106†††	578	0.028	5,063	0.082††	4,170	0.087††	3,757	0.023	3,542
	(0.016)	578	(0.027)	5,063	(0.027)	4,170	(0.028)	3,757	(0.028)	3,542
%Δ earnings	19.585	578	7.786	4,780	33.963†	1,886	34.546	1,375	-6.423	3,148
	(10.482)	578	(8.635)	4,780	(15.560)	1,886	(19.707)	1,375	(15.396)	3,148
Current job	1.557†††	578	0.012	1,920	0.084	2,429	-0.009	2,103	0.040	5,045
	(0.333)	578	(0.055)	1,920	(0.064)	2,429	(0.052)	2,103	(0.038)	5,045
First job	-0.039	481	0.119	221	0.257	162	0.311†	116	0.130	483
	(0.033)	481	(0.084)	221	(0.167)	162	(0.144)	116	(0.059)	483

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