Lecture 10: Education and training

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Introduction

- **Ignorance, one of the five giants**
  - Beveridge report mentions "Ignorance" and thus education policies "*Successful attack on Ignorance is a condition of good government under democracy.*" (UK government, 1942)
  - Policies to increase school leaving age, build more schools, etc.

- **Investment in human capital**
  - Economists' view of education as an investment
  - Private returns in the form of higher earnings
  - Fiscal externalities with higher tax revenues
  - Borrowing constraints lead to too-low investment in human capital

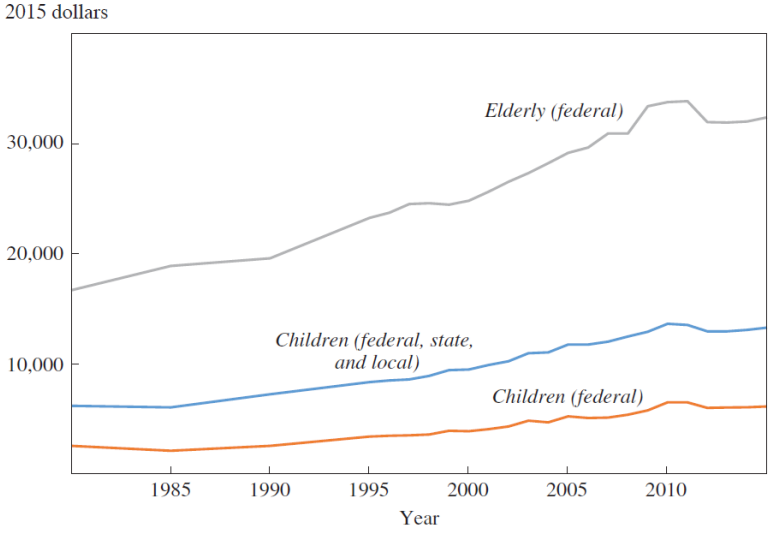
Introduction

- **From schools to early childhood interventions**
  - Early views that increased schooling was key to human capital accumulation
  - More recent view that early intervention have higher returns
  - Heckman's defense of investment from birth to age 5
- **Debate about investment later in life**
  - High returns from investment in schooling
  - Less high returns from training programmes
  - But still often positive cost-benefit analysis

$\Rightarrow$ What are the conditions for effective human capital policies ?

$\Rightarrow$ See more detailed M2 course on "Economics of education"

Figure 1 – Per Capita Spending on Children and the Elderly (US, 1980–2015)



Source : Hoynes and Whitmore Schanzenbach (2018), Fig. 2, p. 95. [web link]

Outline of the lecture

I. **Early childhood interventions**
   1. Foetal hypothesis
   2. Dynamic complementarity
   3. Empirical evidence

II. **Education policies**
   1. Theoretical motivation
   2. Empirical evidence

I. Early childhood interventions

1. Foetal hypothesis
2. Dynamic complementarity
3. Empirical evidence

Foetal origins hypothesis

- **Theory of foetal origins**
  - David Barker's "foetal origins" (Barker, 1990)
  - Prenatal period lays foundation on which the rest of childhood is built
  - Affects outcomes throughout childhood and the rest of life
- **Early analysis**
  - Originally focused on prenatal nutrition
  - Early evidence from famine episodes, war or the 1918 pandemic flu
  - Epidemiology, public health (largely correlational studies)

Early evidence from Dutch famine

- **Dutch Hunger Winter from 1944-45**
  - In October 1944, nazis occupying the Netherlands cut food shipments
  - Very severe famine : which many Dutch were reduced to eating tulip bulb
  - The famine affected fertility, weight gain during pregnancy, and maternal blood pressure
- **Findings on children outcomes**
  - Lower birth weight
  - Middle age : more obesity, lower self-reported health, higher heart disease and worse mental health
- **Other famine studies**
  - Results confirmed using other famine as natural experiments
  - See Almond and Currie (JEP 2011) for a survey of early studies

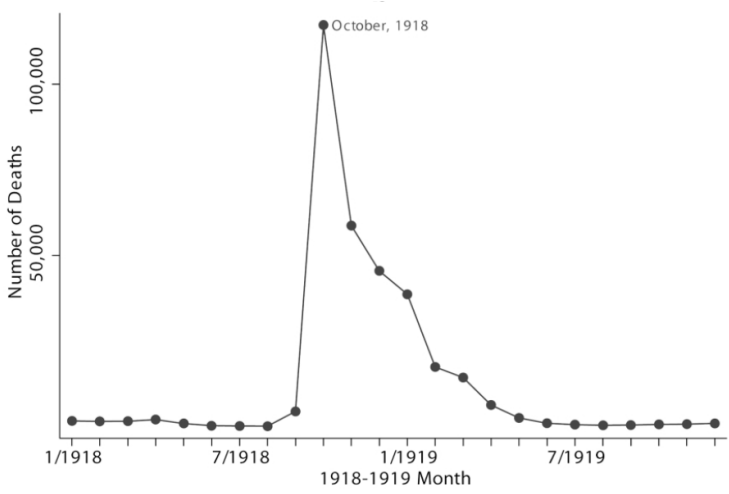
Recent evidence from economics

- **Recent studies**
  - Better identification : more precise data to identify cohorts affected
  - Exploit more diverse shocks (diseases, wars, income shocks, etc.)
  - More varied outcomes, including socio-economics outcomes

- **1918 Influenza Pandemic (Almond, JPE 2006)**
  - Comparison between those born in early 1918 vs 1919
  - Difference in intensity of the pandemic across US States
  - Children of infected mothers were about 20% more likely to be disabled and experienced wage decreases of 5%, and reduced educational attainment

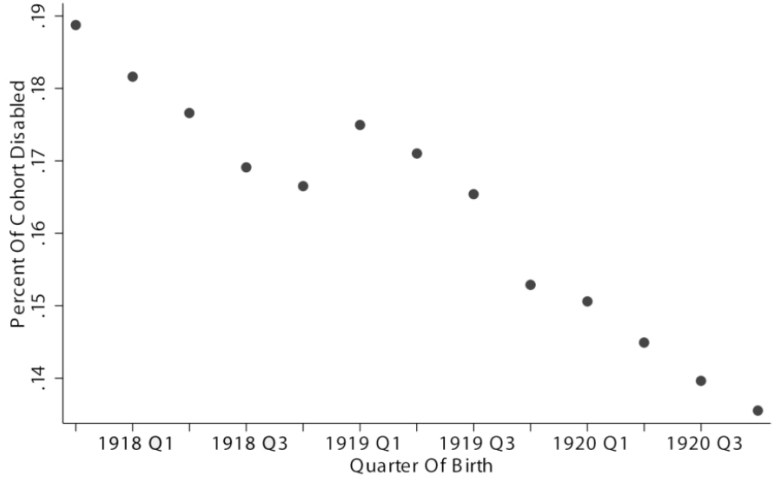
- **France's phylloxera crisis (Banerjee, Duflo, Postel-Vinay and Watts, ReStat 2010)**
  - French vineyards destroyed by phylloxera insects in 1870-1880s
  - Children born to wine-growing families and born in the years and regions affected by the crisis were 0.5 to 0.9 cm shorter in adulthood

Figure 2 – U.S. influenza deaths by month



Source : Almond (2006), Fig. 1.B, p. 674.

Figure 3 – 1980 male disability rates by quarter of birth : prevented from work by a physical disability



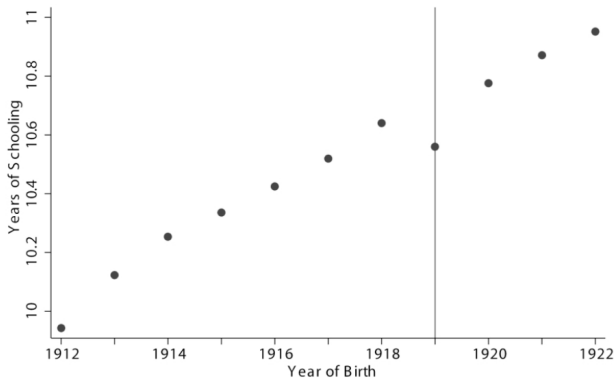
Source : Almond (2006), Fig. 2, p. 675.

Figure 4 – Departure of the 1919 male cohort from the 1912-1922 trend

	Census Year		
Outcome	1960	1970	1980
High school graduate	−.021***	−.020***	−.014***
	[.005]	[.003]	[.003]
Years of education	−.150***	−.176***	−.117***
	[.038]	[.023]	[.019]
Total income	−573*	−1,236***	−1,065***
	[295]	[253]	[191]
Wage income	−812***	−875***	−688***
	[261]	[233]	[179]
Poor (below 150% of the poverty level)	.010**	.009***	.006***
	[.005]	[.002]	[.002]
Neighbors' income (N = 102,948)		−875***	
		[197]	
Socioeconomic status (Duncan's socioeconomic index)	−.640**	−.808***	−.816***
	[.259]	[.157]	[.137]
Disability limits work		.006***	.005**
		[.002]	[.002]
Disability prevents work		.004***	.001
		[.001]	[.002]
Years of disability		.092***	
		[.025]	
Social Security income		1	83***
		[2]	[19]
Welfare income		12**	17**
		[6]	[7]
Observations	114,031	308,785	471,803

Source : Almond (2006), Tab. 2, p. 688.

Figure 5 – 1960 average years of schooling : men and women born in the United States



Source : Almond (2006), Fig. 3, p. 691.

Dynamic complementarity

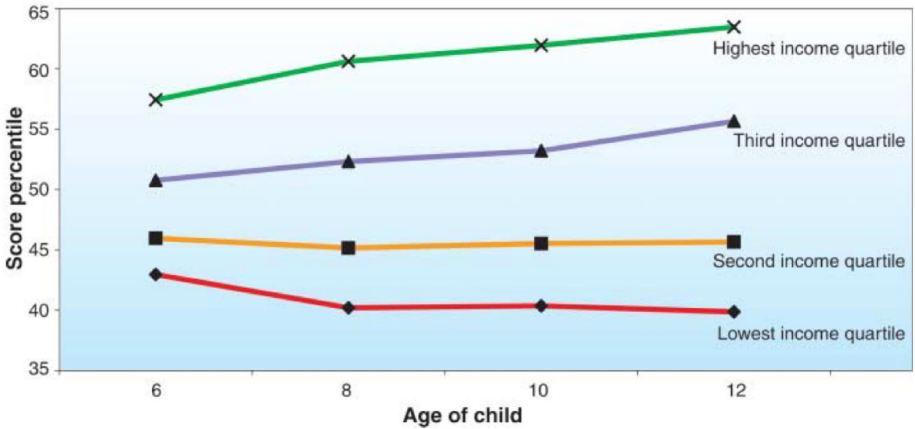
- **Human capital model of dynamic complementarity**
  - Cunha and Heckman (AER, 2007)
  - Human capital is produced with a production function over inputs in two periods :

$$f(\theta_1, \theta_2$$

  - Dynamic complementarities occur when $\frac{\delta f}{\delta \theta_1 \delta \theta_2} > 0$

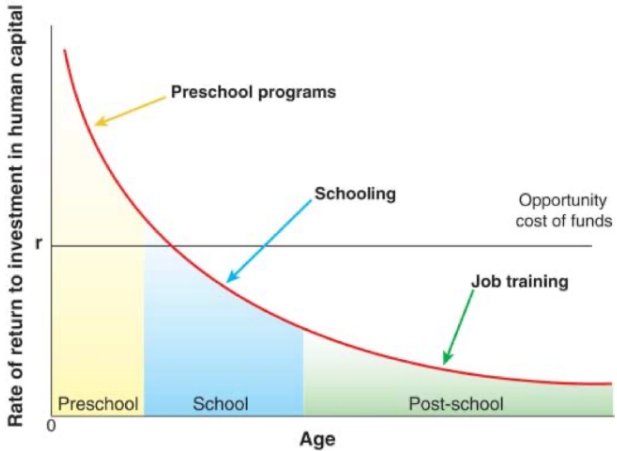
- **Heckman's defense of early childhood interventions**
  - Investment early in childhood increases the returns to later-life investment
  - Returns of early childhood interventions is significantly higher then later investment in human capital
  - Debate whether other interventions in late childhood are provide really lower returns

Figure 6 – Average percentile rank on Peabody Individual Test-Math score by age and income quartile



Source : Heckman (2006), Fig. 1.

Figure 7 – Rate of returns to human capital investment



Source : Heckman (2006), Fig. 2.

Empirical evidence on early childhood interventions

- **Early childhood interventions**
  - Pre-school programmes for kids below aged 5

e.g., *école maternelle* in France

e.g., Head start in the U.S.

- **Main studies in economics from the US**
  - Perry Preschool RCT
  - Abecedarian RCT
  - Introduction of Head Start

HighScope Perry Preschool Programme

- **The programme**
  - Programme for disadvantaged children in the early 1960s
  - A stimulating classroom education
  - Weekly home visits to teach mothers how to best support their child's development
  - Curriculum focused on boosting a child's non-cognitive skill development (e.g., perseverance, problem-solving, grit)
- **One of the most widely-cited preschool studies**
  - Studies 123 children randomly assigned to treatment and control groups
  - Following children until age 40 with outcomes like earnings, employment, education, crime, etc.

HighScope Perry Preschool Programme

- **Impact analysis**
  - Grades and IQs not much affected
  - But later outcomes very positive on employment, earnings, crime
  - Very large estimates of returns to the programme : Rolnick and Grunewald (2003) report a rate of return of 16%
- **Cost-benefit analysis of the program (Heckman et al., JPubE 2010)**
  - More careful analysis of the returns of the programme (with s.e., given 123 obs.)
  - Still very large effects, IRR between 8% to 10%

Figure 8 – Benefits and cost of Perry preschool programme

	Present Value in 1992 Dollars Discounted at 3%		
Benefits*	**For Participant**	**For Public**	**Total**
Child care provided	738	0	738
More efficent K-12 education, such as less grade retention and higher achievement	0	6,872	6,872
Decrease in public adult education costs	0	283	283
Increase in participants' earnings and employee benefits	21,485	8,846	30,331
Decrease in crime	0	70,381	70,381
Increase in publicly funded higher education costs	0	-868	-868
Decrease in welfare payments	-2,653	2,918	265
Total Benefits	19,570	88,433	108,002
Cost of Program	0	-12,356	-12,356
Estimated return on $1 invested in program:			
For Participant and Public:	$8.74 ($108,002 in Benefits/$12,356 for Cost of Program)		
For Public:	$7.16 ($88,433 in Benefits/$12,356 for Cost of Program)		

* Benefits and costs were measured from ages 3 through 27 and projected for ages 28 through 65.

Data source: *The High/Scope Perry Preschool Study Through Age 27*

SOURCE : Rolnick and Grunewald (2003), Tab. 1.A.

Figure 9 – Summary of lifetime costs and benefits of the Perry Preschool Programme (in undiscounted 2006 dollars)

		Crime ratio[a]	Murder cost[b]	Male		Female	
				Treatment	Control	Treatment	Control
Cost of education[c]	K-12/GED[d]			107,575	98,855	98,678	98,349
	College, age ≤27[e]			6705	19,735	21,816	16,929
	Education, age >27[e]			2409	3396	7770	1021
	Vocational training[f]			7223	12,202	3120	674
	Lifetime effect[g]			−10,275		14,409	
Cost of crime[h]	Police/court			105.7	152.9	24.7	53.8
	Correctional			41.3	67.4	0.0	5.3
	Victimization	Separate	High	370.0	729.7	2.9	320.7
		Separate	Low	153.3	363.0	2.9	16.1
		By type	Low	215.0	505.7	2.8	43.3
	Lifetime effect[g]	Separate	High	−433		−352.2	
		Separate	Low	−283		−47.6	
		By type	Low	−364		−74.9	
Gross earnings[i]	Age ≤27			186,923	185,239	189,633	165,059
	Ages 28–40			370,772	287,920	356,159	290,948
	Ages 41–65			563,995	503,699	524,181	402,315
	Lifetime effect[g]			145,461		211,651	
Cost of welfare[j]	Age ≤27			89	115	7064	13,712
	Ages 28–40			831	2701	11,551	5911
	Ages 41–65			1533	2647	6528	7363
	Lifetime effect[g]			−3011		−1844	

SOURCE : Heckman et al. (2010), Tab. 2, p. 119.

Figure 10 – Selected estimates of IRRs (%) and benefit-to-cost ratios of the Perry Preschool Programme

Return		To individual			To society[a]			To society[a]		
Murder cost[b]					High ($4.1M)			Low ($13K)		
		All[d]	Male	Female	All[d]	Male	Female	All[d]	Male	Female
Deadweight loss[c]										
IRR	0%	7.6	8.4	7.8	9.9	11.4	17.1	9.0	12.2	9.8
		(1.8)	(1.7)	(1.1)	(4.1)	(3.4)	(4.9)	(3.5)	(3.1)	(1.8)
	50%	6.2	6.8	6.8	9.2	10.7	14.9	8.1	11.1	8.1
		(1.2)	(1.1)	(1.0)	(2.9)	(3.2)	(4.8)	(2.6)	(3.1)	(1.7)
	100%	5.3	5.9	5.7	8.7	10.2	13.6	7.6	10.4	7.5
		(1.1)	(1.1)	(0.9)	(2.5)	(3.1)	(4.9)	(2.4)	(2.9)	(1.8)
Discount rate										
Benefit–cost ratios	0%	–	–	–	31.5	33.7	27.0	19.1	22.8	12.7
					(11.3)	(17.3)	(14.4)	(5.4)	(8.3)	(3.8)
	3%	–	–	–	12.2	12.1	11.6	7.1	8.6	4.5
					(5.3)	(8.0)	(7.1)	(2.3)	(3.7)	(1.4)
	5%	–	–	–	6.8	6.2	7.1	3.9	4.7	2.4
					(3.4)	(5.1)	(4.6)	(1.5)	(2.3)	(0.8)
	7%	–	–	–	3.9	3.2	4.6	2.2	2.7	1.4
					(2.3)	(3.4)	(3.1)	(0.9)	(1.5)	(0.5)

SOURCE : Heckman et al. (2010), Tab. 1, p. 115.

Head Start Programme

- **The programme : Perry at scale**
  - Launched in 1965 as part of President Lyndon Johnson's war on poverty
  - Free preschool to low-income families (below poverty line)
  - Program that offers education, health, and nutrition services to disadvantaged children and their families

- **Conflicting evaluations**
  - Positive impacts from studies exploiting siblings (Deming 2009)
  - Head Start Impact Study conducted large scale RCT of head start : results are disappointing but also too early to see long-term outcomes
  - Control group also affected by preschool programmes (Kline and Walters, QJE 2016)

II. Education policies

1. Rationales for public intervention
2. Educational policies
3. Empirical evidence on public spending on education

Why public intervention for education ?

- **Socially inefficient choices**
  - Fiscal externalities : higher incomes increase future tax revenue
  - Externalities on others : more education may reduce crime, facilitate business, civic engagements, etc.
- **Privately inefficient choices**
  - Divergence between parent and child preferences
  - Borrowing constraints : Children cannot efficiently invest
  - Optimization failures : individuals misperceive returns to education

Forms of public intervention

- **Public schools**
  - Direct provision of free education
  - Define curriculum, teaching practices
  - Set mandatory education period, class size, geographic enrollment, etc.
  - Define recruitment, training, pay and pension of teachers
- **Subsidies for private schools**
  - Vouchers to families (e.g., Chile 1980s, US local voucher programs since the 1990s)
  - Direct subsidies to private schools (e.g., in France private school teachers paid by the State)

Forms of public intervention

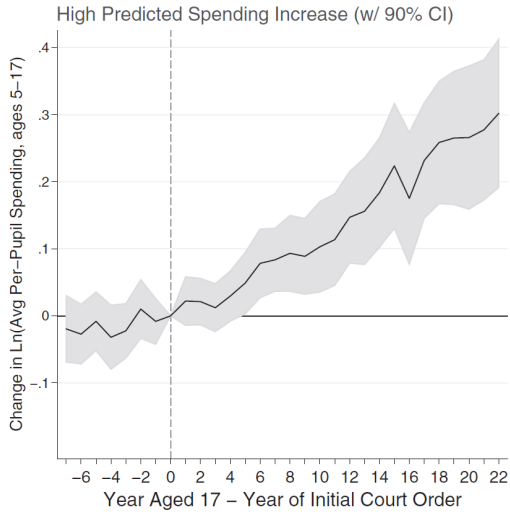
- **Income contingent loans**
  - Loans to students with repayment conditional on reaching sufficient earnings
  - Implemented in a few countries : Australia (1989), New Zealand (1991), South Africa (1991), Chile (1994), UK (1997)
- **Charter schools**
  - Private schools, with large autonomy, but funded publicly
  - Aim to offer alternative to public schools to low income parents
  - Development in the US, and the UK

Impact of public spending on education

- **Jackson, Johnson, and Persico (2016 QJE)**
  - Exploit variation in school finance reform in the U.S.
  - "Public K-12 education" : US term for primary and secondary education
  - Compare the adult outcomes of cohorts that were differentially exposed to school finance reforms, depending on place and year of birth

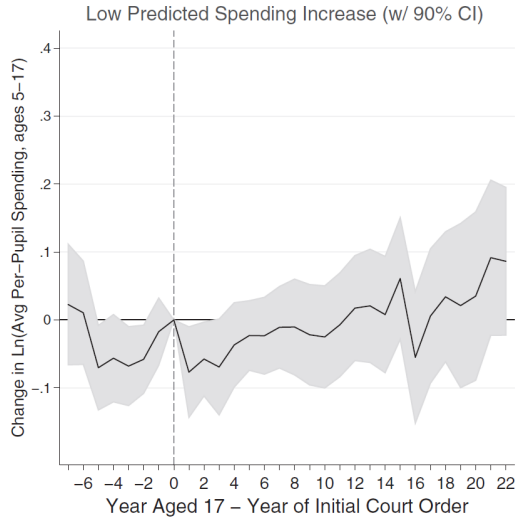
- **Court reforms in the 1970s**
  - Prior to the 1970s, most resources spent on K-12 schooling was raised through local property taxes
  - This led to variations across areas in school funding
  - State supreme courts overturned school finance systems in 28 states between 1971 and 2010

Figure 11 – Effect of Court-Ordered School Finance Reform on Per Pupil Spending



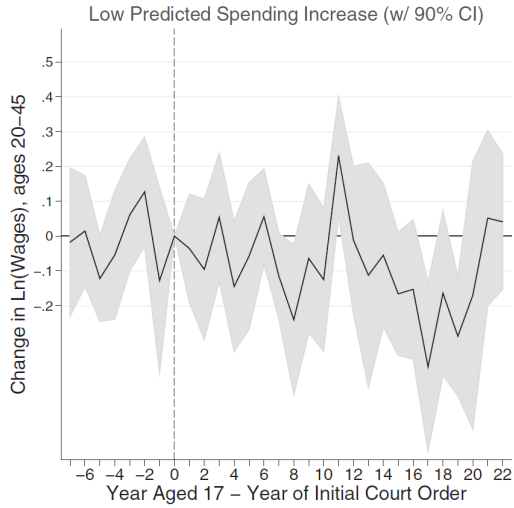
Source : Jackson, Johnson, and Persico (2016), Fig. II, p. 181.

Figure 12 – Effect of Court-Ordered School Finance Reform on Per Pupil Spending



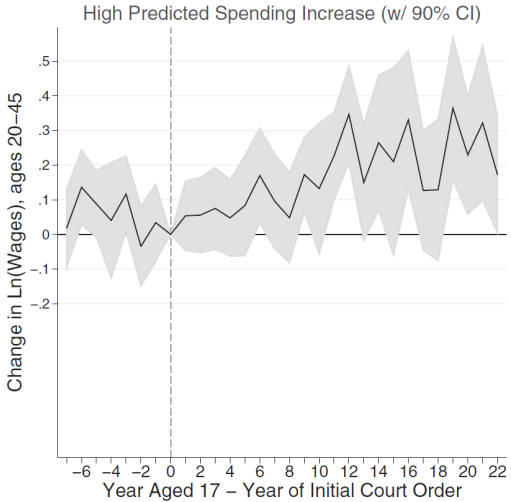
Source : Jackson, Johnson, and Persico (2016), Fig. II, p. 182.

Figure 13 – Effect of Court-Ordered School Finance Reform on ln(Wage)



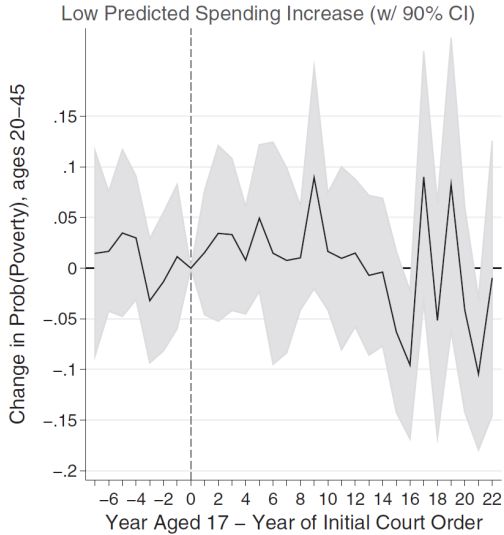
SOURCE : Jackson, Johnson, and Persico (2016), Fig. IV, p. 195.

Figure 14 – Effect of Court-Ordered School Finance Reform on ln(Wage)



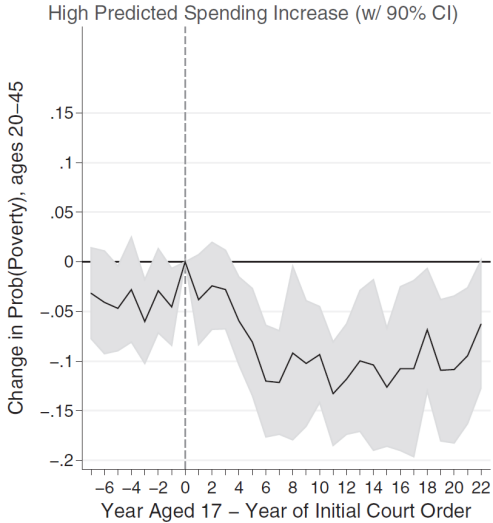
SOURCE : Jackson, Johnson, and Persico (2016), Fig. IV, p. 196.

Figure 15 – Effect of Court-Ordered School Finance Reform on Poverty



SOURCE : Jackson, Johnson, and Persico (2016), Fig. V, p. 201.

Figure 16 – Effect of Court-Ordered School Finance Reform on Poverty



Source : Jackson, Johnson, and Persico (2016), Fig. V, p. 202.

Impact of public spending on education

- **Large impact of increased school finance**
  - A 10% increase in per pupil spending leads to
  - 0.31 more years of completed education
  - 7% higher wage
  - 3.2 ppt reduction in the annual incidence of adult poverty
  - Effects are much more pronounced for low income families

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