

Skills, Schools and Synapses

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Introduction

- The accident of birth plays a powerful role in explaining variability in lifetime income.
- It is estimated that 50% of the variability of the present value (discounted value) of lifetime earnings is determined by age 18.
- The remaining 50% is determined by market forces – “luck” – determined after family influence wanes.
- The modern welfare state operates to reduce both sources of inequality.
- As currently configured, it is far more effective at reducing market risk than family risk.

- Redistributing the same resources toward the early years will reduce inequality and boost productivity.
- Families are under strain in many countries around the world.
- Dysfunctional families account in part for a slowdown in the growth of skills.
- At a time when highly skilled workers are in great demand, growth in the supply of skills has stalled or slowed down in many economies.
- There is evidence of polarization in the labor market in many OECD countries.

- A greater proportion of young people going to college.
- At the same time, a greater proportion of young people dropping out of secondary school and into an underclass of persons not working and not going to school.

- Immigrant assimilation has proved to be a difficult task.
- Enclaves have formed with low rates of intergenerational mobility out of poverty.
- These and other social problems are strongly rooted in conditions children face in their formative years.

Why Invest in Disadvantaged Children?

- The traditional argument is based on fairness and social justice.
- Even ignoring these arguments, there are benefits for society at large.
 - Reduction in crime and promotion of integration of persons into society.
 - Improvement in the efficiency of schools.
 - Increase in the productivity of workers.
- On pure productivity enhancement grounds, the case for early intervention for disadvantaged children is strong.

- Early childhood programs targeted toward disadvantaged children promote economic efficiency.
- They also reduce poverty.
- For such programs there is no “equity-efficiency” tradeoff.
- Society can achieve *both* objectives through such policies.
- Most European economies currently overinvest in ineffective remediation and active labor market programs and underinvest in the early childhood years, especially for disadvantaged children.
- Redistributing the budget toward early childhood will reduce inequality and promote efficiency.

How is this Possible?

- A large, convincing, body of research in psychology, economics and neuroscience points to the importance of the early years in producing successful outcomes for the advantaged and in accounting for social pathologies found among the disadvantaged.
- The technology of skill formation explains some basic facts about human development.
- Skill begets skill.
- Motivation begets motivation.
- Motivation begets skill.
- Skill begets motivation.

- Research on the technology of skill formation has led to major rethinking of policies for human development.

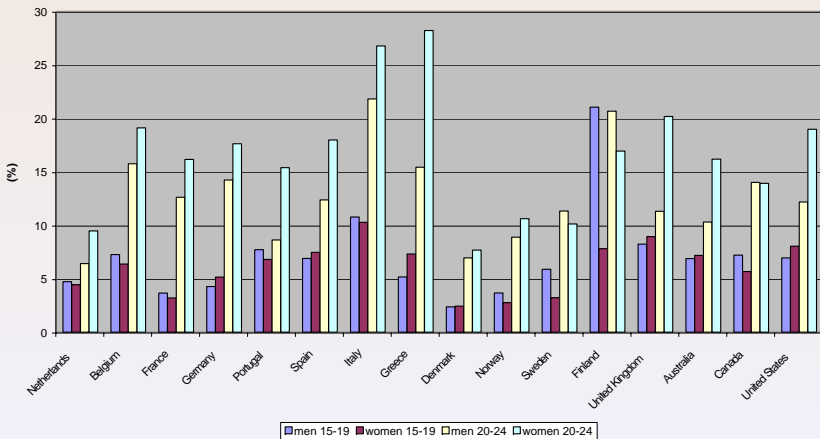
- The early years exert a powerful influence over the rest of the life of a child.
- I am talking about the years 0-3 as well as the later preschool years 4-5.
- Children raised in disadvantaged environments are much less likely to succeed in schools and in economic and social life and are much less likely to be healthy adults.

- The good news for policy makers is that there is strong evidence that early environments can be enriched and that we can offset, in part, the powerful consequences of the accident of birth.
- In my lecture today, I summarize the argument for early intervention.
- First, some unpleasant facts.

Some Facts About Rising Inequality and the Slowdown in the Growth of Skills

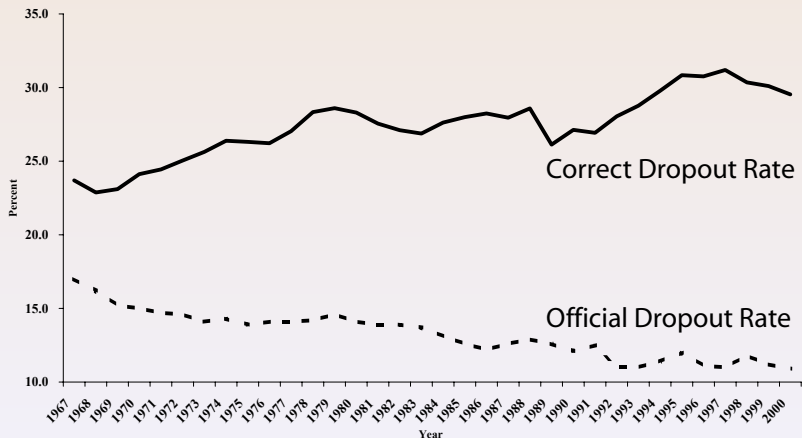
- Unnoticed in recent discussions of inequality is the growth in the percentage of youth who are high school dropouts.
- Properly counted, the high school dropout rate is increasing in the U.S.
- Similar phenomena appear in many OECD countries.
- This leads to a growing underclass.

Fraction of Young Cohorts Neither in School Nor Employment (2002)



Source: OECD Social Indicators 2005

The American High School Dropout Rate is Increasing



— U.S. Dropout Rate (Including GEDs) - - Official U.S. Dropout Rate (Excluding GEDs)

Source: (1) The National Center for Education Statistics Digest of Educational Statistics, 2001, Tables 103 and 108; (2) NCES, Dropout Rates in the United States, 2002

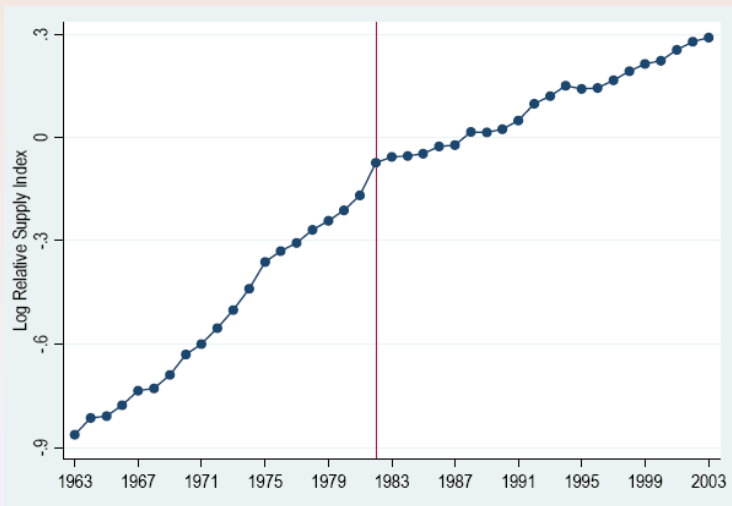
- The official dropout rate in the U.S. understates the true dropout rate because it counts exam certified “graduates” (GEDs) as regular high school graduates who show up for class and complete courses.
- In truth, GEDs — exam certified graduates — are dropouts; they earn the wages of dropouts and have the same poor labor market performance.
- At the same time, a greater fraction of traditional high school graduates is attending college.

- This produces growing polarization in society. The percentage of people who graduate college is growing. So is the percentage of people who have dropped out of high school. This is producing a shrinking middle class.
- There are parallel phenomena going on in many countries around the world.
- Immigrant assimilation rates are low, and disparities between immigrants and non-immigrants are increasing in most societies.

- The growth in the secondary school dropout rate will produce serious problems in the future for society because crime, health, productivity, teenage pregnancy and drug use are all linked to educational attainment.
- This problem exacerbates the decline in the supply of skills due to falling population found in many European countries.

- **Quantity of workers** — The future labor force will come disproportionately from disadvantaged families compared to historical proportions.
- This is due in part to rising immigration.
- Disadvantaged families create adverse environments for developing children.
- **Quality of workers** — Growth in educational attainment is slowing.
- Aaronson and Sullivan (2001) and De Long et al. (2003) estimate that the slowdown in the growth of labor force quality will reduce the productivity growth of labor in the U.S. economy by 0.18-0.29% per year compared to its historical average.

Relative supply of college equivalent labor, 1963–2003 (March CPS).



Source: Autor, Katz, and Kearney (2005).

Education And Crime

- Strong negative relationship between education and participation in crime.
- Early interventions targeted toward disadvantaged children have been documented to reduce crime.

- Lochner and Moretti (2004) establish that education is a better policy than additional police or incarceration for reducing crime.
- Educational expenditure (to achieve high school graduation status) is four times more effective in reducing crime than expenditure on police officers.

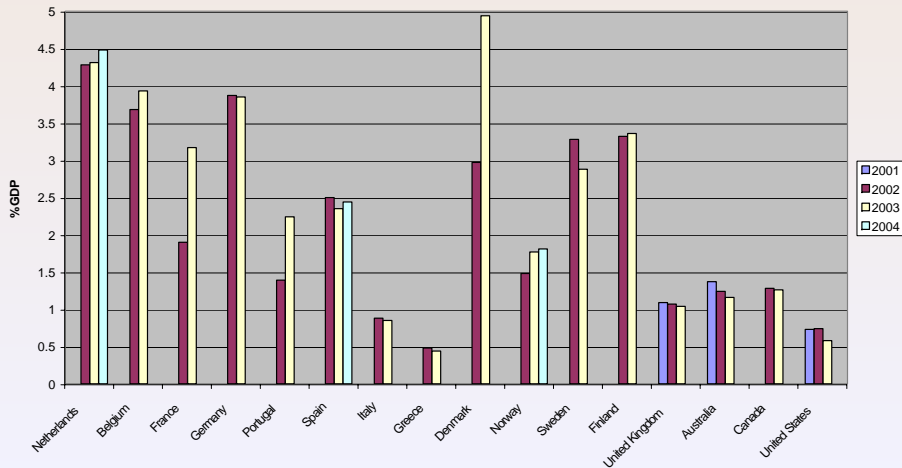
What Causes These Adverse Trends?

- What forces produce these low levels and adverse trends?
- Are the public schools responsible?
- Can we look to school reform to fix the problem?
- Will active labor market programs fix these problems?
- Are higher college tuition costs to blame?
- The answer is “No” to all of these questions.

- Contrary to prevailing views, accounting for the ability of a child at the age college decisions are made, tuition costs and schooling quality explain a trivial fraction of the gaps in educational attainment by socioeconomic status.
- It is essential to adopt a life cycle perspective to understand these questions and to properly allocate educational planning and investment.

- European states need to prioritize their budgets in new ways and emphasize the early years in their skill formation policy.
- Currently there is substantial spending on “active” labor market programs: ALMP.

Total expenditure on training and passive/active labor market programmes (%GDP), Source: OECD Labor Force Statistics, 2005



What are the Key Employment Challenges and Policy Priorities for OECD Countries?

- A large array of studies surveyed in Heckman, LaLonde, and Smith (1999) and Martin and Grubb (2001), as well as more recent studies, show that ALMP programs at current levels of funding have at best minor long term effects on wages and employment and most do not survive a cost-benefit test.
- Few programs lift most participants out of poverty.
- They are primarily focused on older workers (older than 25).
- This creates an opportunity where, at no cost to the public budget, public expenditure can be made more efficient.

The Argument for Early Intervention in a Nutshell

- 1 Many major economic and social problems such as crime, teenage pregnancy, dropping out of high school and adverse health conditions can be traced to low levels of skill and ability in society.
- 2 We need to recognize the multiplicity of abilities.
- 3 Current public policy discussions focus on promoting and measuring cognitive ability through IQ and achievement tests. For example, the accountability standards in the No Child Left Behind Act in the U.S. concentrate attention on achievement test scores, not evaluating a range of other factors that promote success in school and life.

- 4 Cognitive abilities are important determinants of socioeconomic success.
- 5 So are socio-emotional skills, physical and mental health, perseverance, attention, motivation, and self confidence. They contribute to performance in society at large and even help determine scores on the tests that are used to monitor cognitive achievement.
- 6 Ability gaps between the advantaged and disadvantaged open up early in the lives of children.
- 7 Family environments of young children are major predictors of cognitive and socio-emotional abilities, as well as crime, health and obesity.

- 8 This observation is a major source of concern because family environments in many other advanced countries around the world have deteriorated over the past 40 years.
- 9 Experimental evidence on the effectiveness of early interventions in disadvantaged families supports by a positive example a large body of non-experimental evidence that adverse family environments harm child outcomes.
- 10 If society intervenes early enough, it can raise cognitive and socio-emotional abilities and the health of disadvantaged children.
- 11 Early interventions promote schooling, reduce crime, foster workforce productivity and reduce teenage pregnancy.

- 12 These interventions are estimated to have high benefit-cost ratios and rates of return.
- 13 As programs are currently configured, early interventions have much higher economic returns than later interventions such as reduced pupil-teacher ratios, active labor market programs, convict rehabilitation programs, adult literacy programs, tuition subsidies or expenditure on police.

- 14 Life cycle skill formation is dynamic in nature. Skill begets skill; motivation begets motivation. Motivation begets skill. If a child is not motivated and stimulated to learn and engage early on in life, the more likely it is that when the child becomes an adult, it will fail in social and economic life. The longer society waits to intervene in the life cycle of a disadvantaged child, the more costly it is to remediate disadvantage. Similar dynamics appear to be at work in creating child health and mental health.
- 15 A major refocus of policy is required to understand the life cycle of skill and health formation and the importance of the early years in creating inequality, and in producing skills for the workforce.

Ability Matters

- Social problems including disease are strongly related to shortfalls in both cognitive skills, noncognitive skills (motivation, perseverance, self discipline, self control), and health.
- Controlling for ability, minorities are more likely to attend college than others despite their lower family incomes (Cameron and Heckman, 2001).

Ability Explains Schooling Gaps.

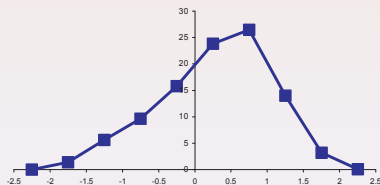
	White-Black Gap	White-Hispanic Gap
High School Completion Gap		
Actual White-Minority Gap	.06 (.01)	.14 (.02)
Ability Adjusted Gap	-.14 (.03)	-.12 (.04)
Population College Entry Gap (Unconditional on HS Completion)		
Actual White-Minority Gap	.12 (.02)	.14 (.02)
Ability Adjusted Gap	-.16 (.03)	-.15 (.04)

Source: Cameron Heckman (2001).

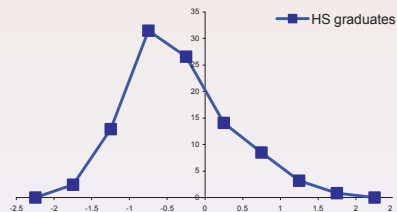
- Both cognitive and personality/socio-emotional abilities explain many features of economic and social performance and the emergence of health differentials.
- Evidence from the second chance GED program in America (Heckman and Rubinstein, 2001).

Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling

White Males



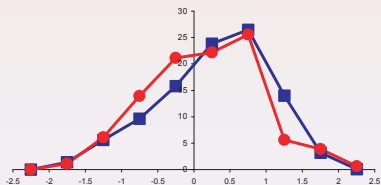
White Females



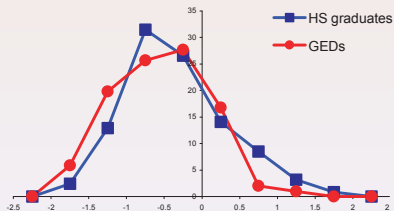
Source: Heckman, Hsee and Rubinstein (2001)

Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling

White Males

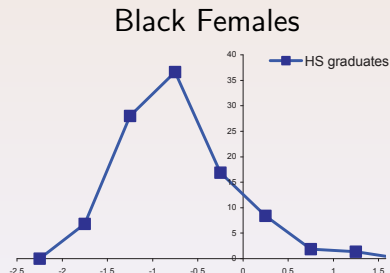
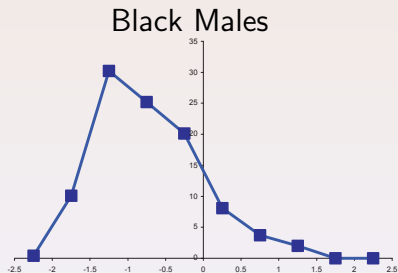


White Females



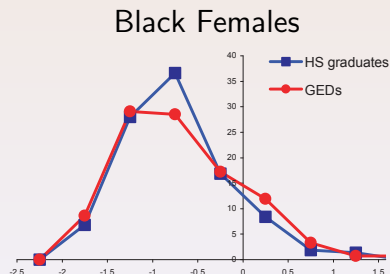
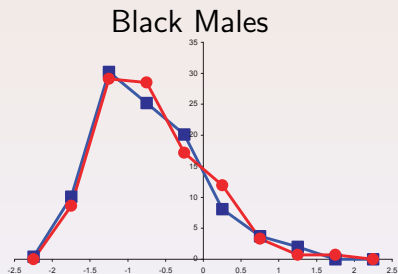
Source: Heckman, Hsee and Rubinstein (2001)

Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling



Source: Heckman, Hsee and Rubinstein (2001)

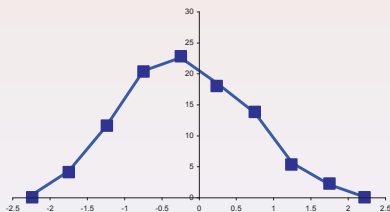
Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling



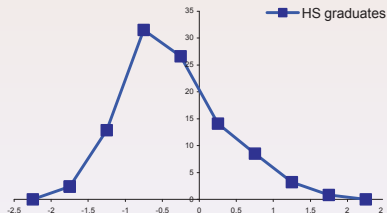
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Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling

Hispanic Males



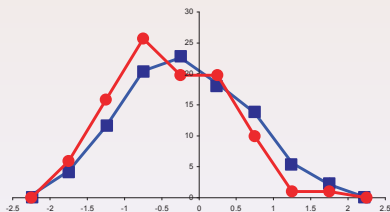
Hispanic Females



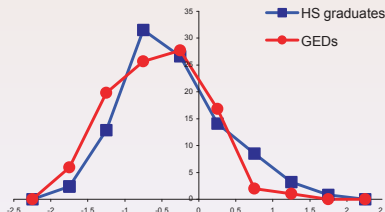
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Density of age adjusted AFQT scores, GED recipients and high school graduates with twelve years of schooling

Hispanic Males



Hispanic Females

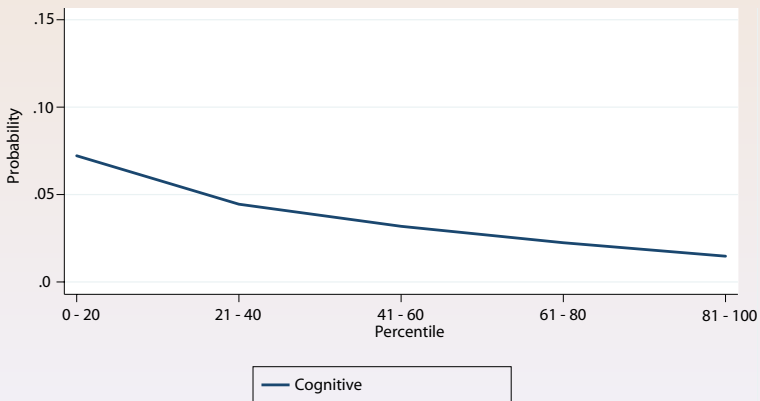


Source: Heckman, Hsee and Rubinstein (2001)

- GEDs earn at the rate of high school dropouts.

- Effects of both cognitive and noncognitive skills measured in the early years on many measures of adolescent and adult social performance.

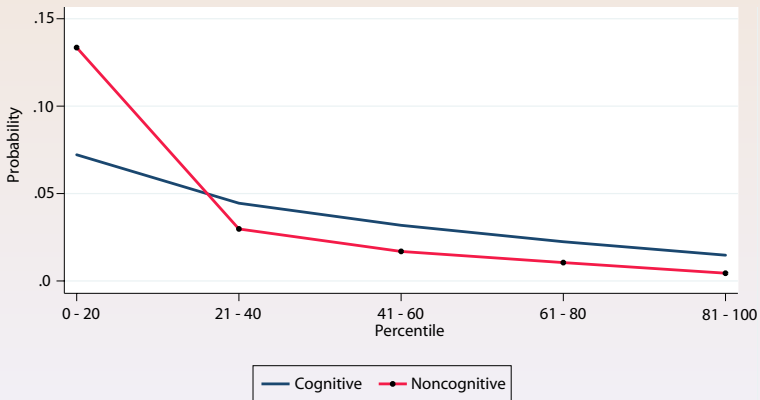
Ever been in jail by age 30, by ability (males)



Note: This figure plots the probability of a given behavior associated with moving up in one ability distribution for someone after integrating out the other distribution. For example, the lines with markers show the effect of increasing noncognitive ability after integrating the cognitive ability.

Source: Heckman, Stixrud, and Urzua (2006).

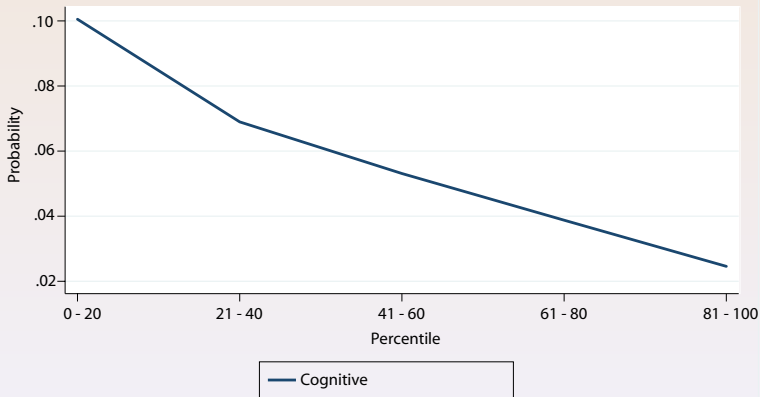
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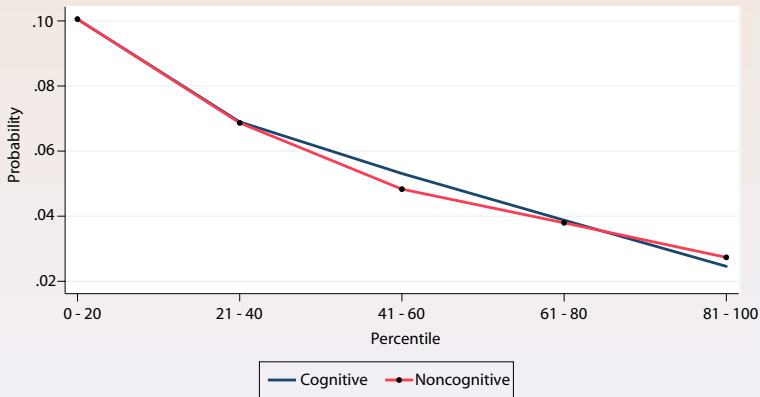
Probability of teenage pregnancy



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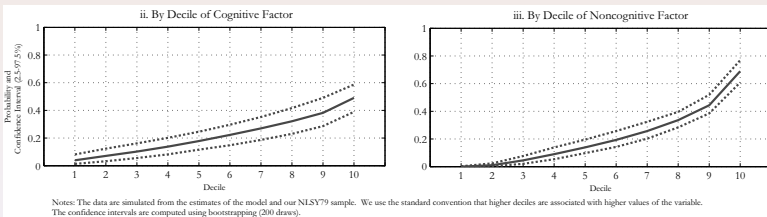
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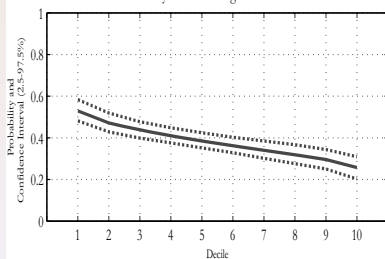
Source: Heckman, Stixrud, and Urzua (2006).

Probability of being a 4-year college graduate by age 30 (males)

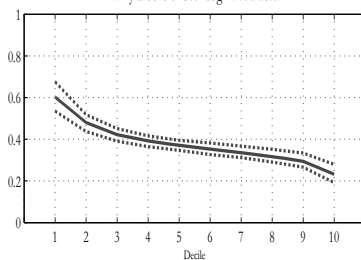


Probability of daily smoking by age 18 (males)

ii. By Decile of Cognitive Factor

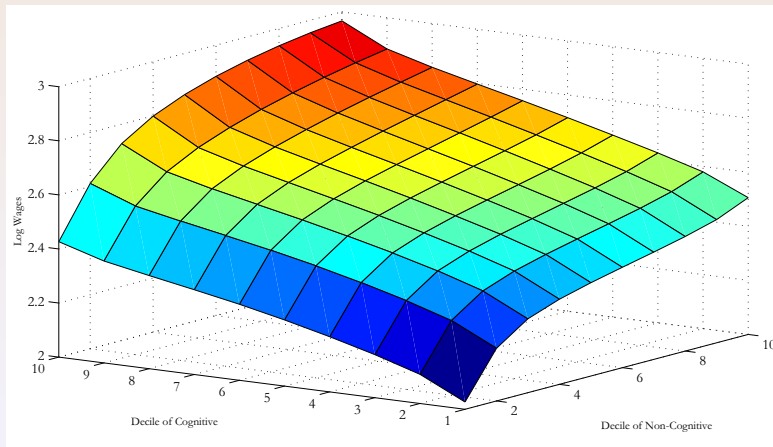


iii. By Decile of Noncognitive Factor

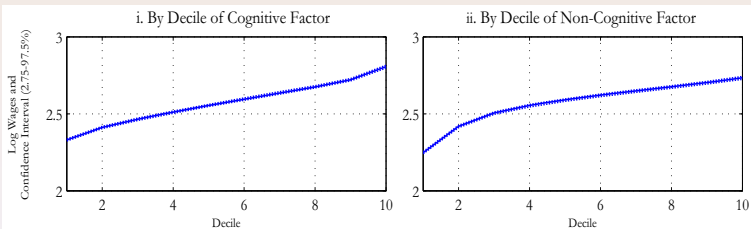


Notes: The data are simulated from the estimates of the model and our NLSY79 sample. We use the standard convention that higher deciles are associated with higher values of the variable. The confidence intervals are computed using bootstrapping (200 draws).

Mean log wages by age 30 (males)



Mean log wages by age 30 (males)



Notes: The data are simulated from the estimates of the model and our NLSY79 sample. We use the standard convention that higher deciles are associated with higher values of the variable. The confidence intervals are computed using bootstrapping (50 draws).

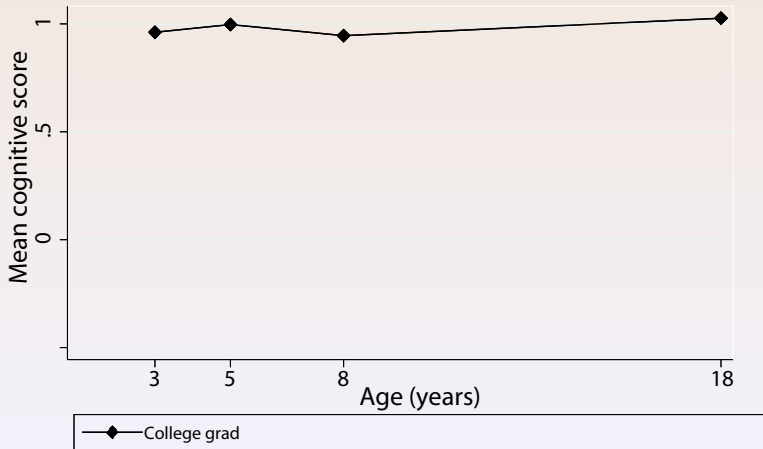
Gaps Open Up Early

- Gaps in the abilities that play such important roles in determining diverse adult labor market and health outcomes open up early across socio-economic groups.
- Schooling after the second grade plays only a minor role in alleviating these gaps.
- Measures of schooling quality (teacher/pupil ratios and teacher salaries) that receive so much attention in public forums play only a minor role in creating or eliminating the gaps after the first few years of schooling.

- Schooling quality and school resources have relatively small effects on ability deficits and only marginally account for any divergence in test scores by age across children from different socioeconomic groups.
- In the U.S., this is surprising given the huge inequality in schooling quality across socio-economic groups.
- Going across income groups, gaps in cognitive ability widen slightly in the early years of schooling.
- They stay constant after age 8.

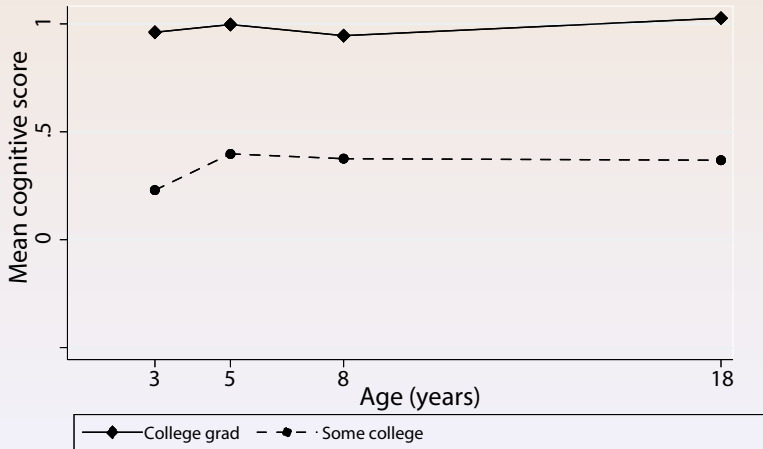
- Research shows that schooling quality, pupil teacher ratios, teacher pay and the like play only a small role in accounting for these gaps or in widening or narrowing them.
- The gaps start early before school begins and they persist.
- Once one controls for early family environments, the gaps substantially narrow.

Trend in mean cognitive score by maternal education



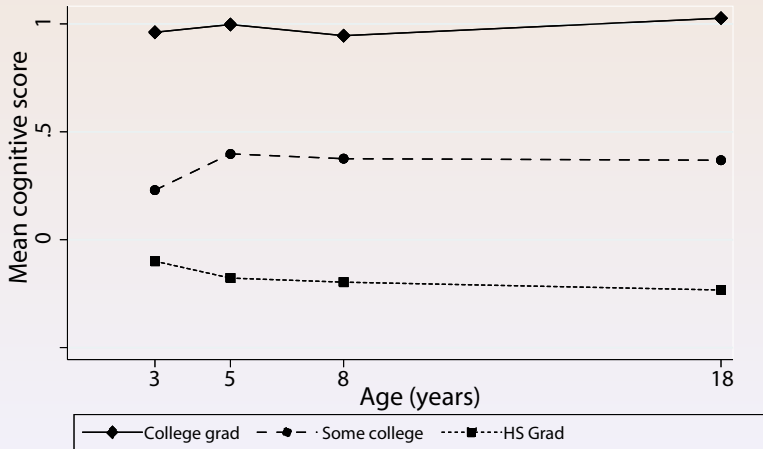
Each score standardized within observed sample. Using all observations and assuming data missing at random. Source: Brooks-Gunn et al. (2006).

Trend in mean cognitive score by maternal education



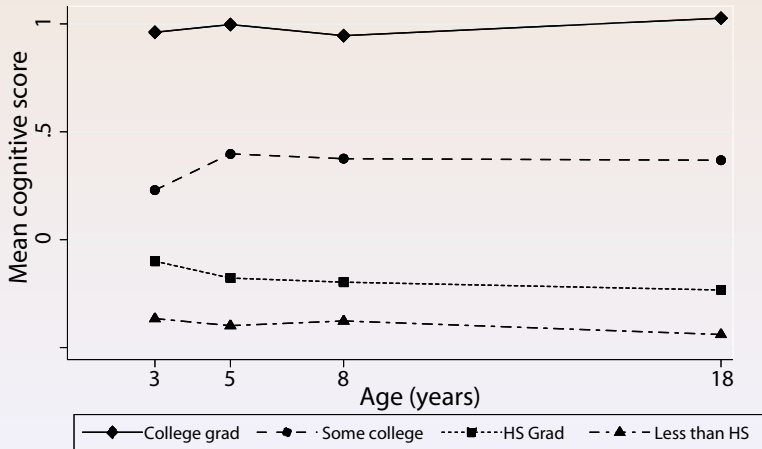
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Trend in mean cognitive score by maternal education



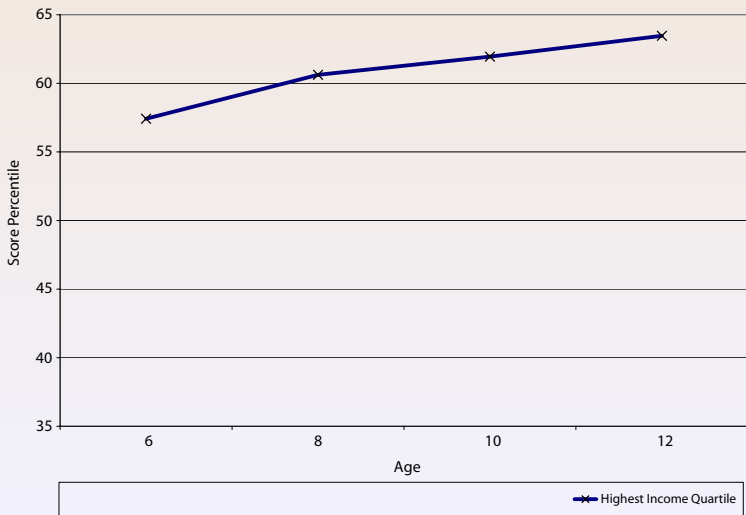
Each score standardized within observed sample. Using all observations and assuming data missing at random. Source: Brooks-Gunn et al. (2006).

Trend in mean cognitive score by maternal education

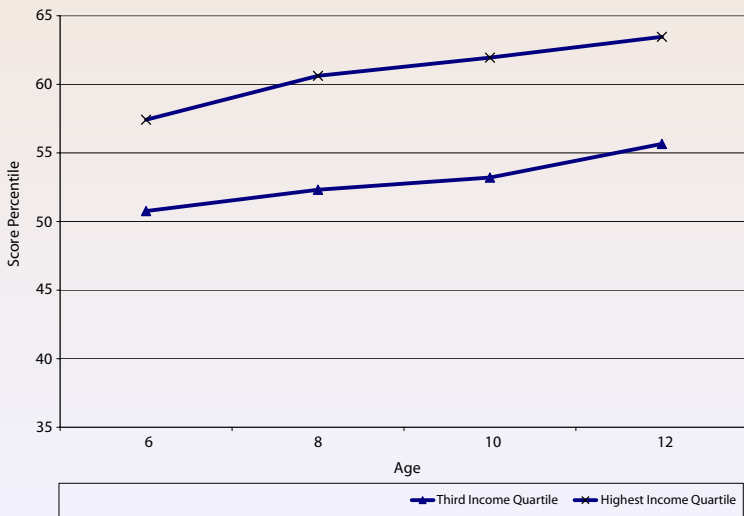


Each score standardized within observed sample. Using all observations and assuming data missing at random. Source: Brooks-Gunn et al. (2006).

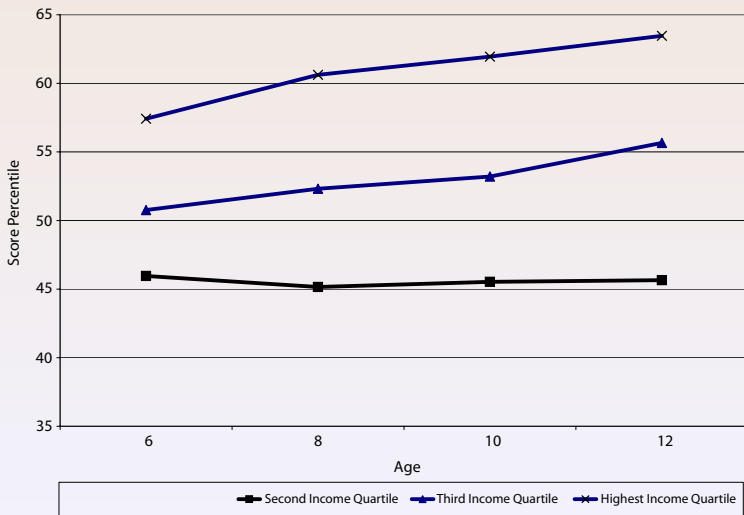
Average percentile rank on PIAT-Math score, by income quartile



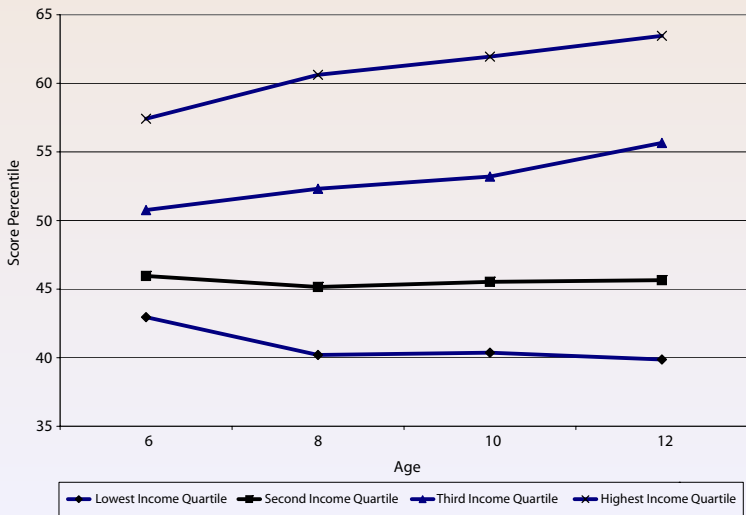
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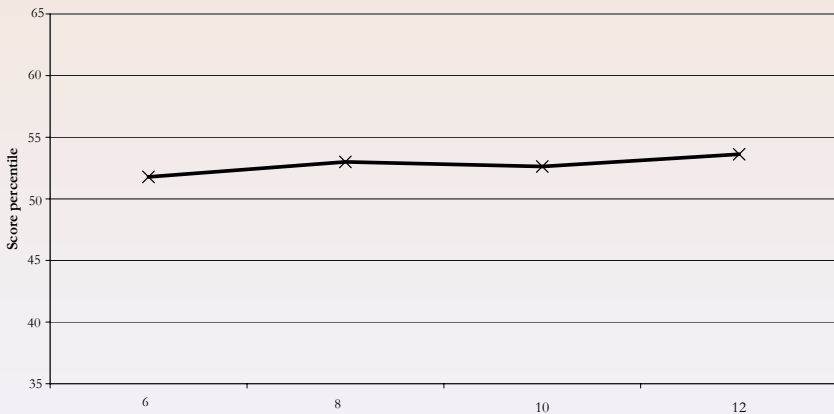
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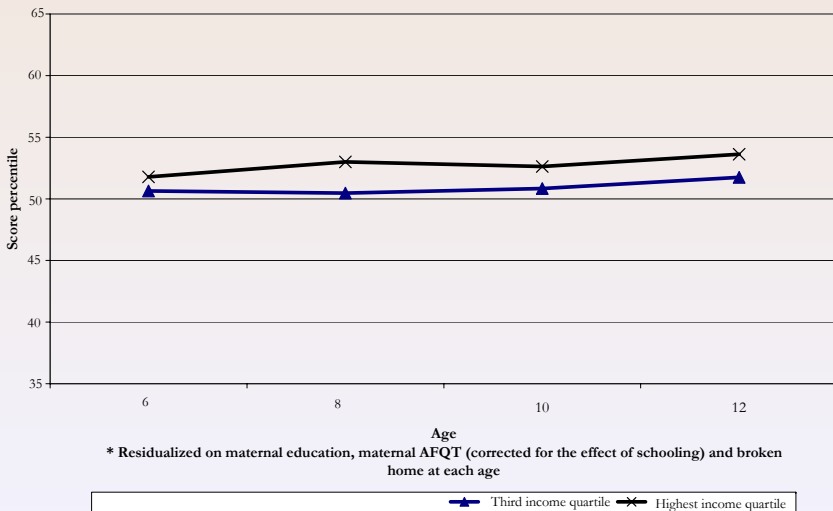
Adjusted average Math score percentiles by income quartile



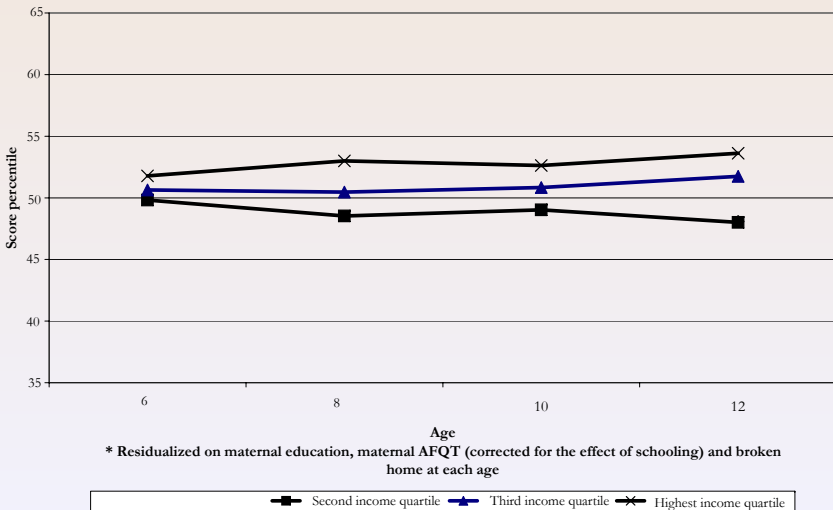
* Residualized on maternal education, maternal AFQT (corrected for the effect of schooling) and broken home at each age

—x— Highest income quartile

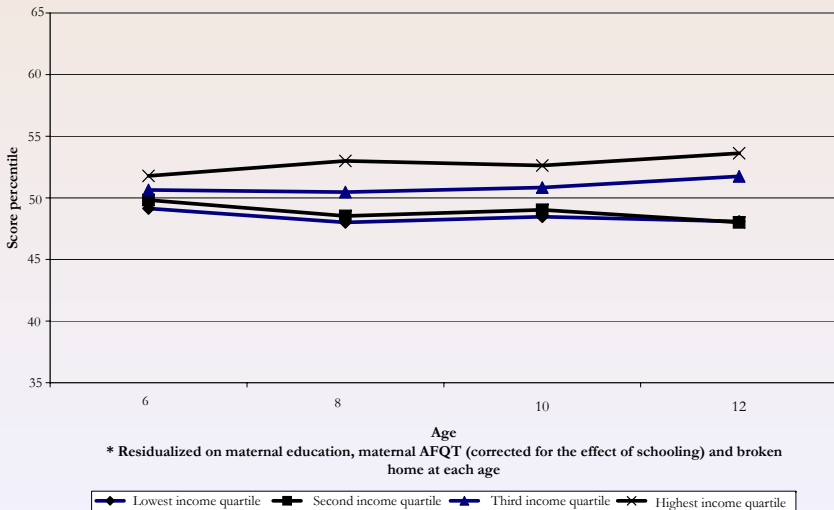
Adjusted average Math score percentiles by income quartile



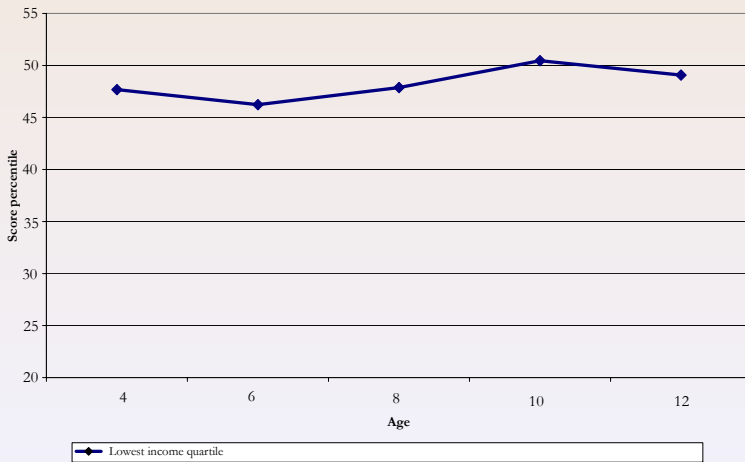
Adjusted average Math score percentiles by income quartile



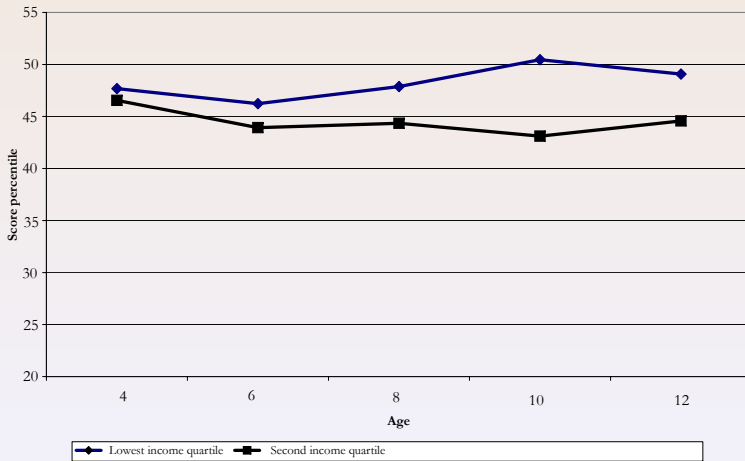
Adjusted average Math score percentiles by income quartile



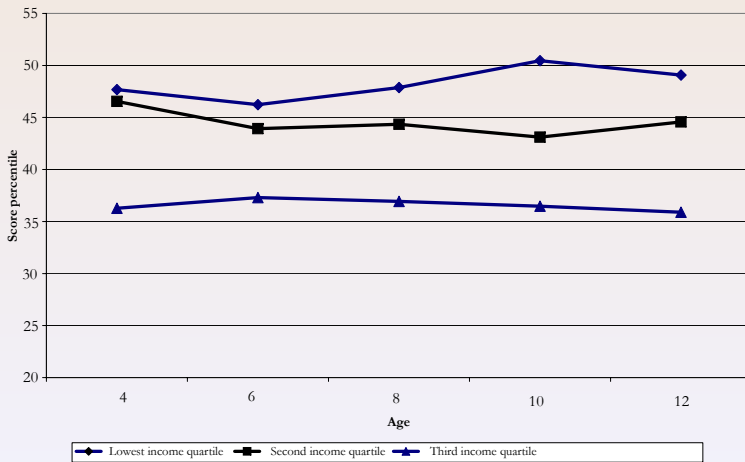
Average percentile rank on anti-social behavior score, by income quartile



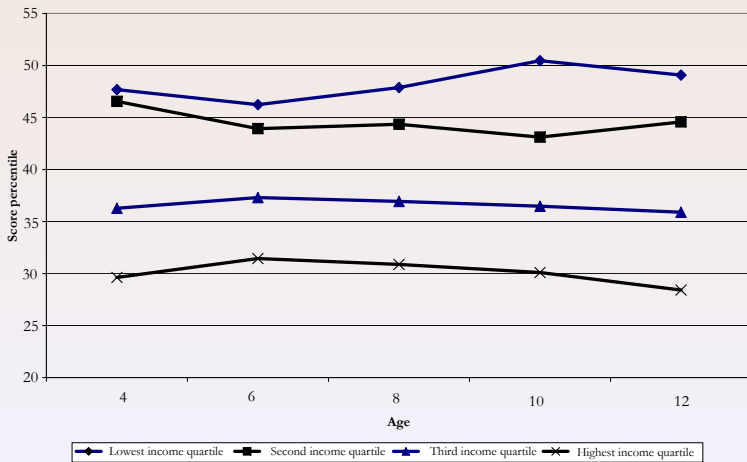
Average percentile rank on anti-social behavior score, by income quartile



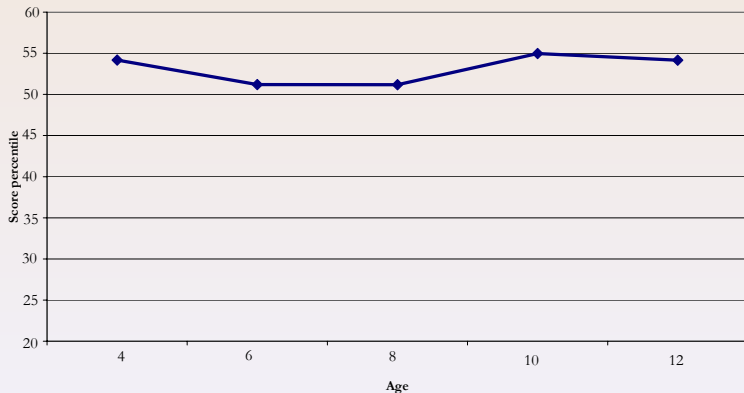
Average percentile rank on anti-social behavior score, by income quartile



Average percentile rank on anti-social behavior score, by income quartile



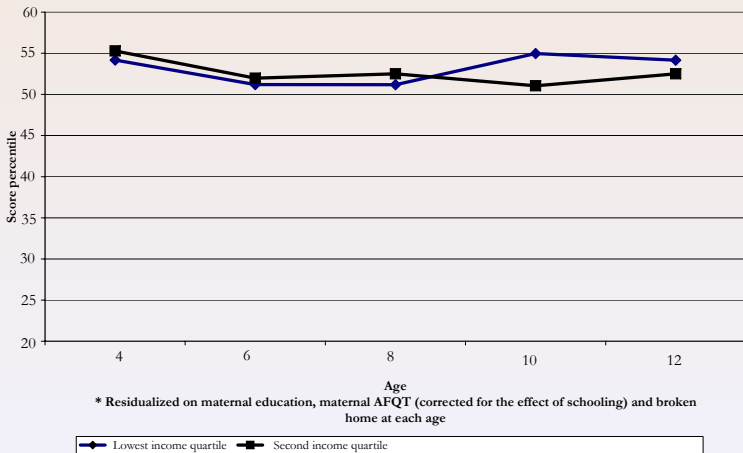
Adjusted average anti-social behavior score percentile, by income quartile



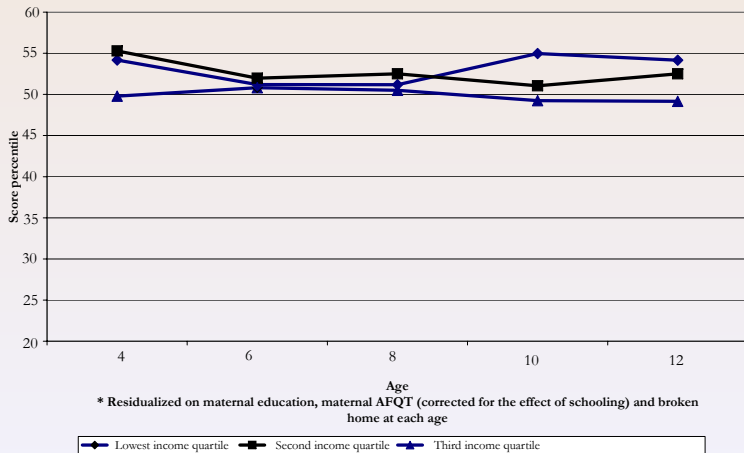
* Residualized on maternal education, maternal AFQT (corrected for the effect of schooling) and broken home at each age

—◆— Lowest income quartile

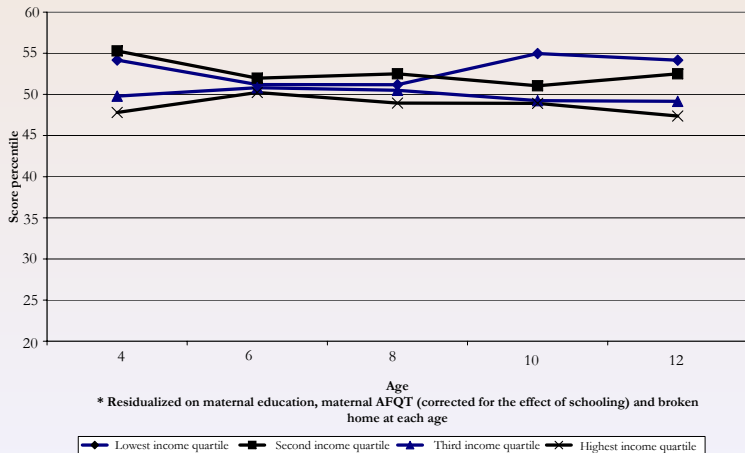
Adjusted average anti-social behavior score percentile, by income quartile



Adjusted average anti-social behavior score percentile, by income quartile



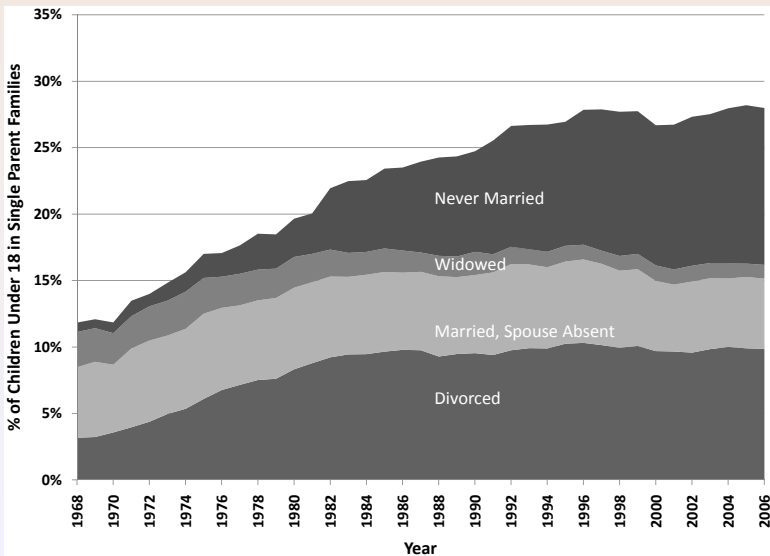
Adjusted average anti-social behavior score percentile, by income quartile



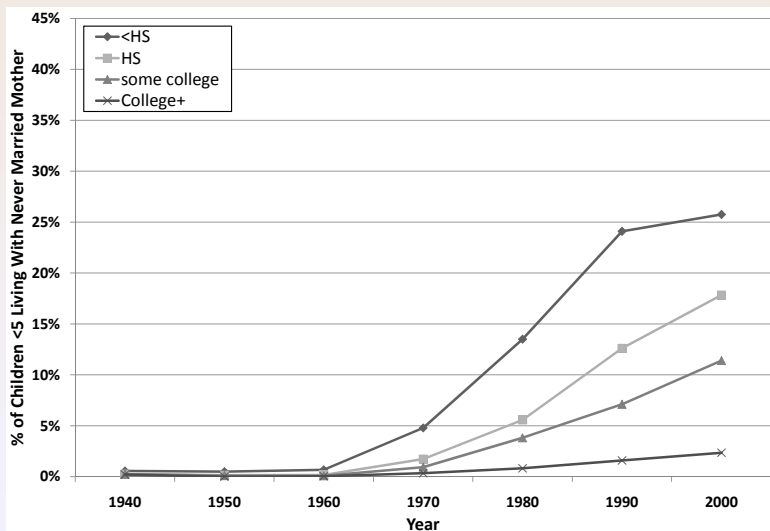
Family Factors

- Evidence that family factors matter is a source of concern because a growing fraction of all American children are born into disadvantaged families. This is also happening in many countries in Western Europe.
- A divide is opening up in early family environments; those born into disadvantaged environments are receiving relatively less stimulation and child development resources than those from advantaged families.
- The real source of child disadvantage is parenting.

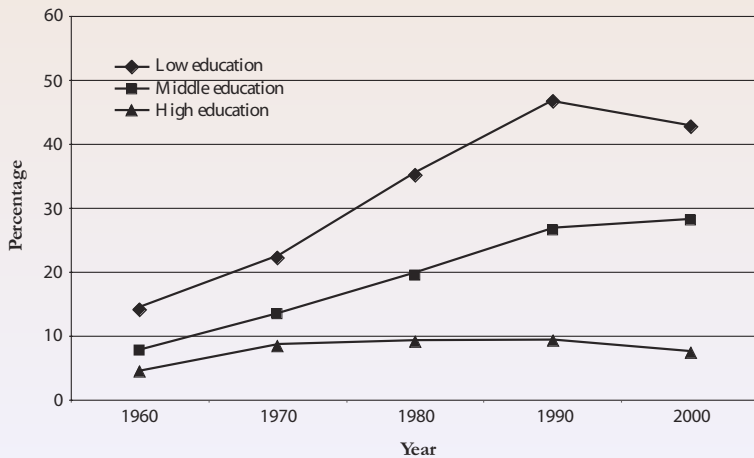
Percent of Children Under 18 Living with One Parent, By Marital Status of Single Parent



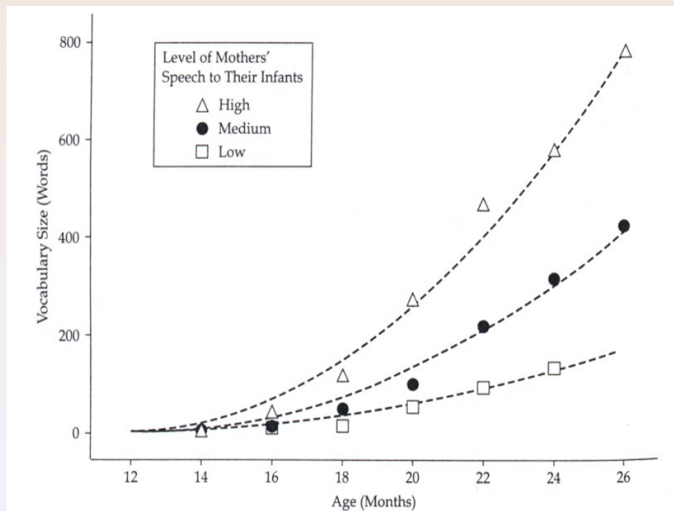
Percent of All Children Less than Five With Never-Married Mother by Mother's Education



Trends in Single Motherhood, 1960 to 2000



Mothers' Speech and Child Vocabulary



Source: Huttenlocher *et al.* (1991)

Risk Factors Among Less-Educated Families, by Parents' Relationship Status

Risk Factor	Relationship Status		
	Married	Cohabiting	Single
Mothers' Health			
Depression	10.2	15.0 ^a	14.9 ^a
Prenatal drug use	1.0	6.3 ^a	8.8 ^{a,b}
Prenatal smoking	10.4	25.5 ^a	25.9 ^a
Fathers' Health			
Substance abuse	4.3	4.1 ^a	7.6 ^{a,b}
Disability	5.8	7.5 ^a	6.6
Violence	2.0	3.5	6.1 ^{a,b}
Incarceration	12.2	31.6 ^a	39.2 ^{a,b}
Family structure			
Father has a child with other partner	19.0	33.5 ^a	44.1 ^{a,b}
Mother has a child with other partner	21.6	40.8 ^a	41.5 ^a
Father not working	7.8	19.5 ^a	39.2 ^{a,b}
Income/needs ratio	2.28	1.46 ^a	1.13 ^{a,b}
Disrupt by age 1	8.9	30.9 ^a	65.1 ^{a,b}
Disrupt by age 3	16.9	47.6 ^a	78.2 ^{a,b}
Quality of Mothering			
Child was breast-fed	62.4	47.5 ^a	38.9 ^{a,b}
Nonpunitive interaction	4.79	4.48 ^a	4.29 ^{a,b}
Language stimulation	9.29	9.06 ^a	9.03 ^a

Source: Author's calculations, using data from the Fragile Families and Child Wellbeing Study.

Note: The sample is limited to mothers with a high school degree or less.

^aDifferent from married at $p < .05$.

^bDifferent from cohabiting at $p < .05$.

The Adverse Childhood Experiences (ACE) Study (Felitti and Anda)

- The largest study of its kind ever done to examine the effects of adverse childhood experiences on health and human development over the lifespan (17,337 participants).
- The study shows with data that the insights of Freud about the effects of adverse early childhood environments are correct.
- Exactly what feature of early trauma or adverse environment affects child outcomes is not yet known.

Disease

ACEs Increase Likelihood of Heart Disease*

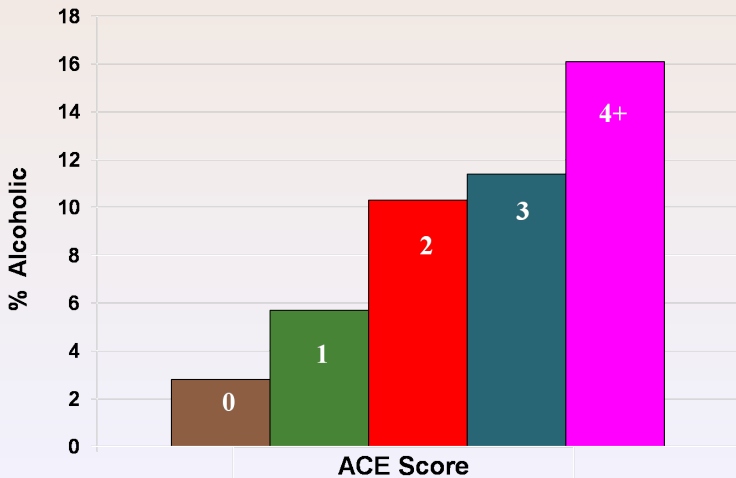
- Emotional abuse 1.7x
- Physical abuse 1.5x
- Sexual abuse 1.4x
- Domestic violence 1.4x
- Mental illness 1.4x
- Substance abuse 1.3x
- Household criminal 1.7x
- Emotional neglect 1.3x
- Physical neglect 1.4x



*After correction for age, race, education, and conventional risk factors like smoking and diabetes.
Circulation, Sept 2004.

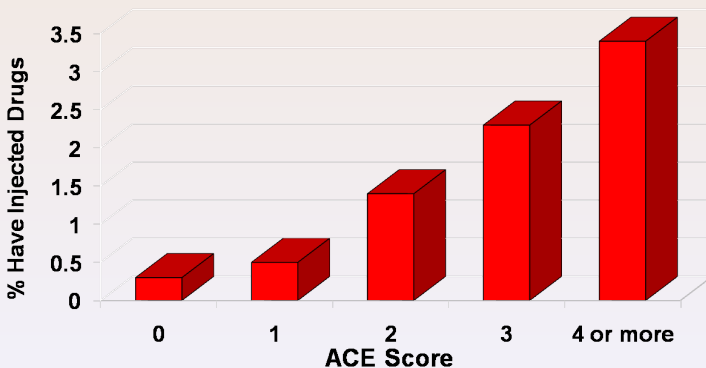
Health Risk

Childhood Experiences vs. Adult Alcoholism

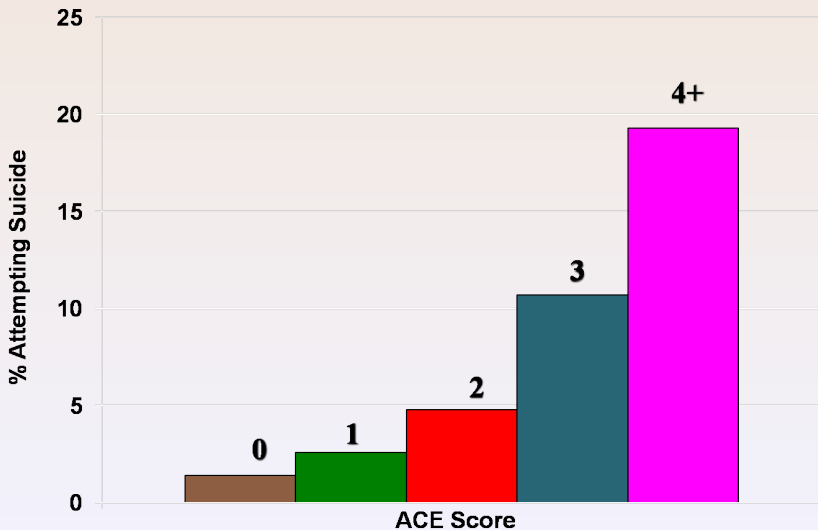


Health Risk

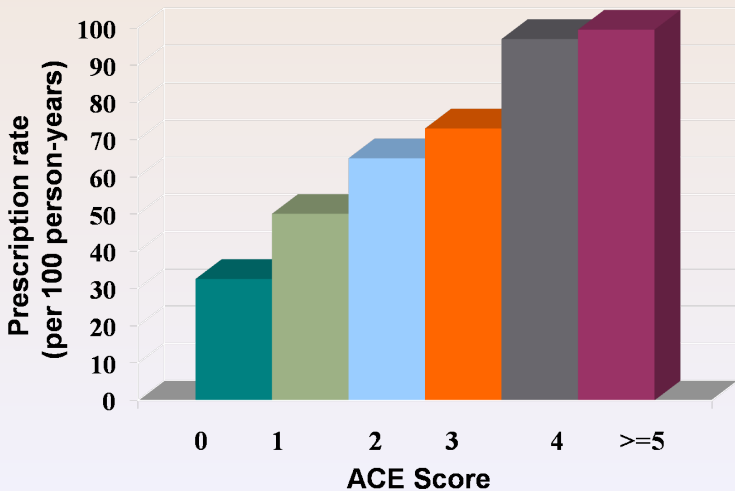
ACE Score vs Intravenous Drug Use



Childhood Experiences Underlie Later Suicide

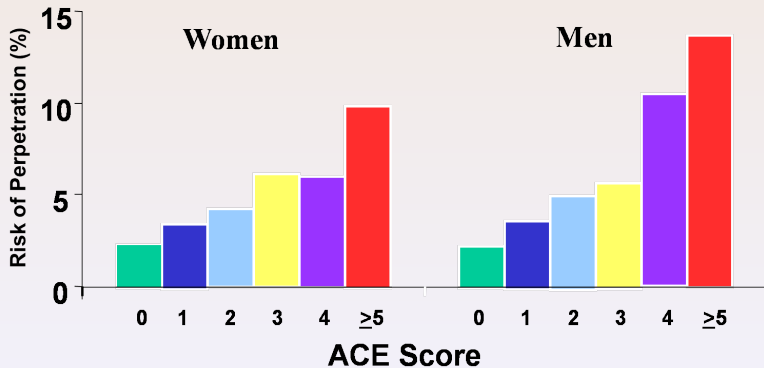


ACE Score and Rates of Antidepressant Prescriptions



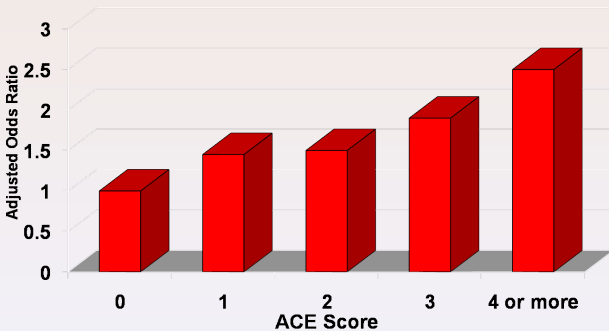
Well-being

ACE Score and the Risk of Perpetrating Domestic Violence



Disease

Adverse Childhood Experiences vs. History of STD



Adverse Childhood Experiences and the Likelihood of:

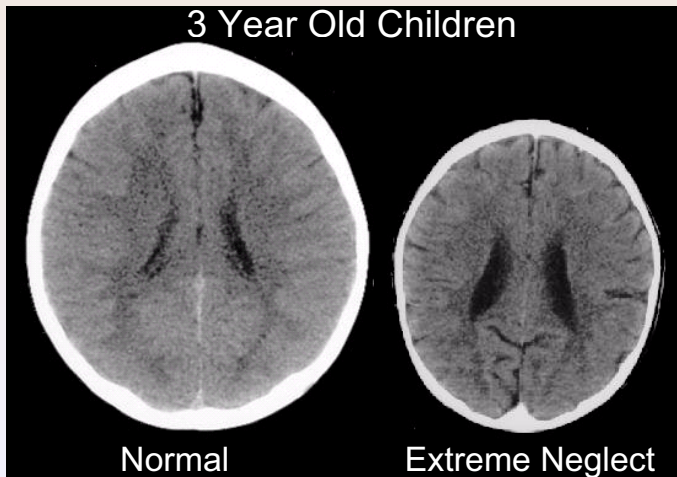
ACE Score	Multiple Sexual Partners*	3 or More Marriages*	Unwanted Pregnancy* (abortion)
0	1.0	1.0	1.0
1	1.6	1.5	1.5
2	1.9	1.6	1.7
3	3.4	2.3	2.3
4	4.4	2.9	2.1
≥5	5.8	3.8	2.9

***Adjusted Odds Ratio**

Experience During Circuit Maturation Is Effective

- Romanian infant studies support this notion.
- Romanian infants in orphanages received virtually no stimulation (intellectual or otherwise).
- They were adopted out.
- The earlier the remediation and better the adoptive environment, the better the child outcome.

Figure: Abnormal brain development following sensory neglect in early childhood



Enriched Early Environments Can Compensate In Part For Risk Features of Disadvantaged Environments

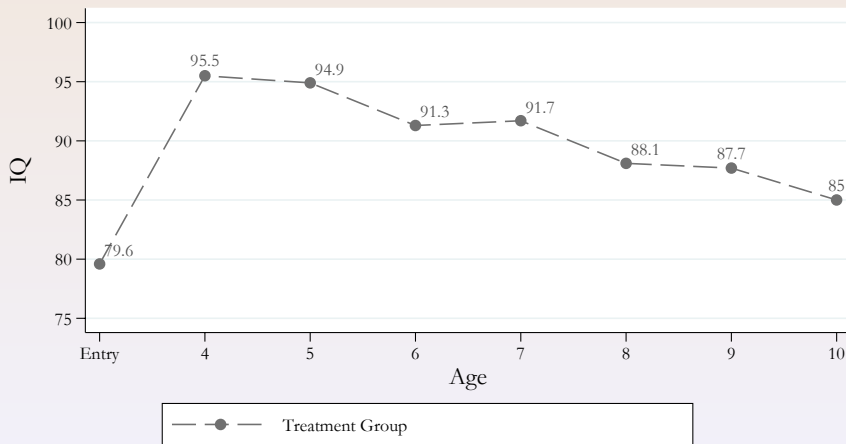
- Experiments that enrich the early environments of disadvantaged children show that the effects of early environments on adolescent and adult outcomes are causal. Improvements in family environments enhance outcomes and affect both cognitive and noncognitive skills.
- Noncognitive skills are an important channel of improvement.

Perry preschool program

- A great deal of public policy discussion around the world focuses on cognitive test score measurements.
- It is important to recognize that more than raw smarts or knowledge on an achievement test is required for success in life.
- Failure to do so leads to bad policy.
- Head Start in the late 1960s was deemed a failure because it did not raise IQ.
- The Perry preschool program enriched the lives of low income black children with initial IQs of 80 at age 3.
 - $2\frac{1}{2}$ hours per day
 - 5 days per week
 - 2 years
 - home visits
 - program stops after two years

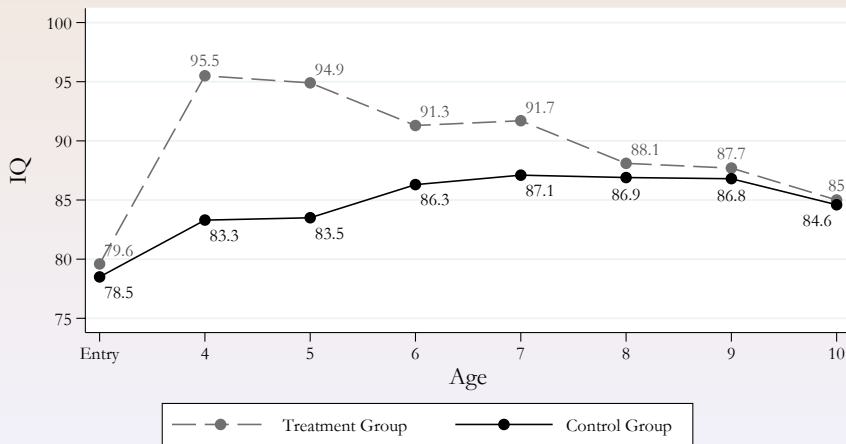
- Perry did not raise IQ.
- It raised noncognitive skills.

Perry preschool program: IQ, by age and treatment group



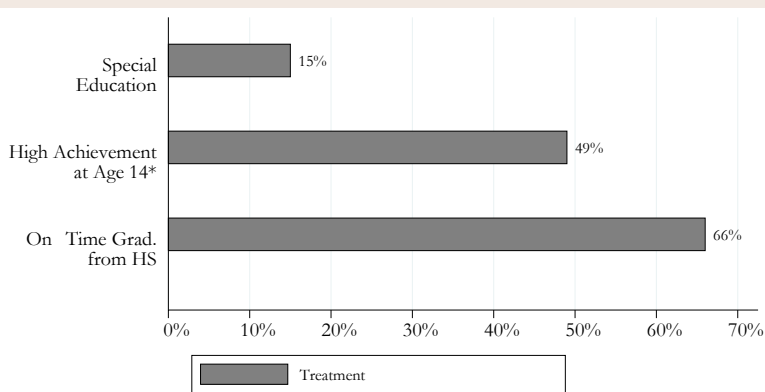
Source: Perry Preschool Program. IQ measured on the Stanford Binet Intelligence Scale (Terman & Merrill, 1960). Test was administered at program entry and each of the ages indicated.

Perry preschool program: IQ, by age and treatment group



Source: Perry Preschool Program. IQ measured on the Stanford Binet Intelligence Scale (Terman & Merrill, 1960). Test was administered at program entry and each of the ages indicated.

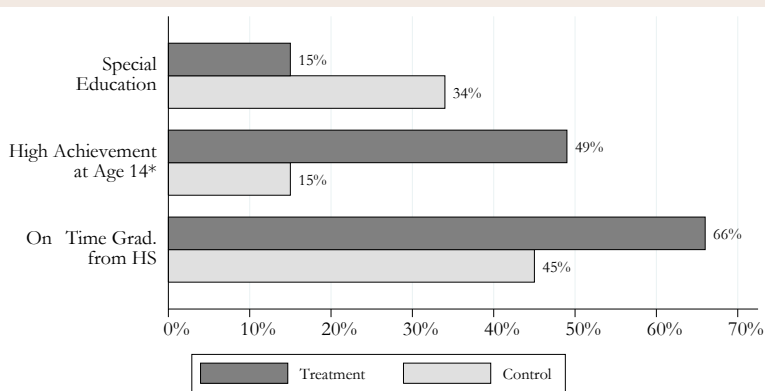
Perry preschool program: educational effects, by treatment group



Source: Barnett (2004).

Notes: *High achievement defined as performance at or above the lowest 10th percentile on the California Achievement Test (1970).

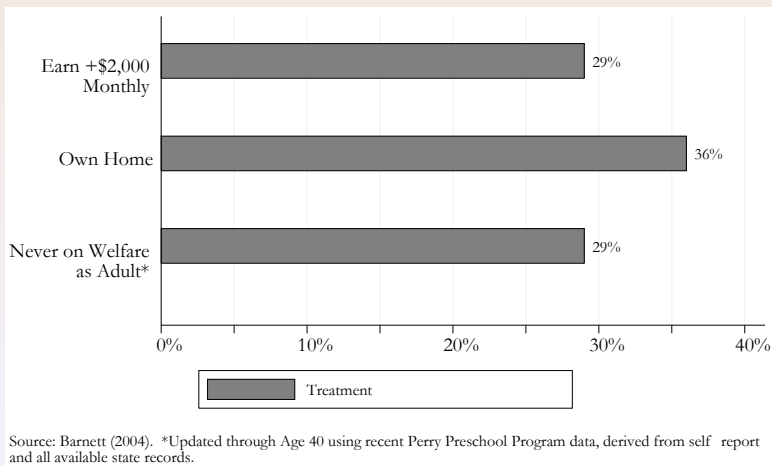
Perry preschool program: educational effects, by treatment group



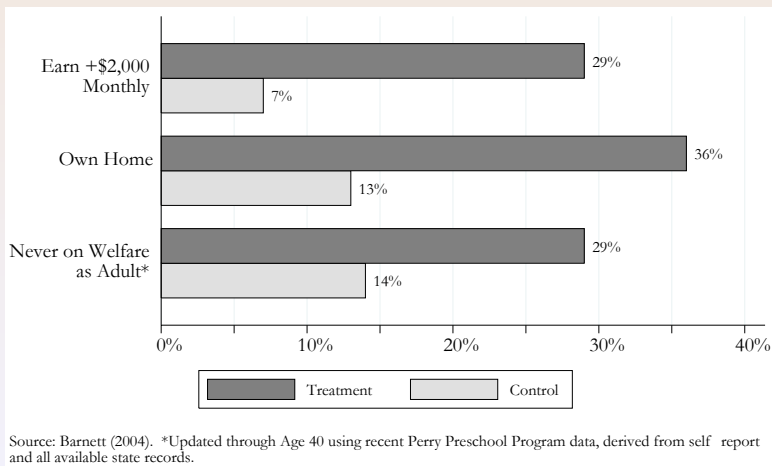
Source: Barnett (2004).

Notes: *High achievement defined as performance at or above the lowest 10th percentile on the California Achievement Test (1970).

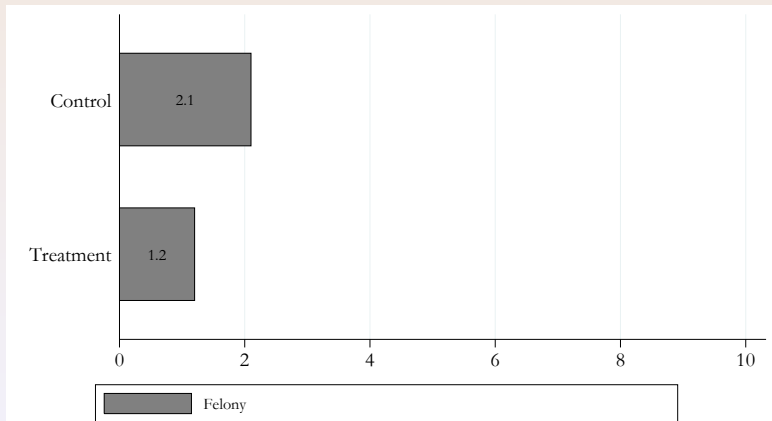
Perry preschool program: economic effects at age 27, by treatment group



Perry preschool program: economic effects at age 27, by treatment group

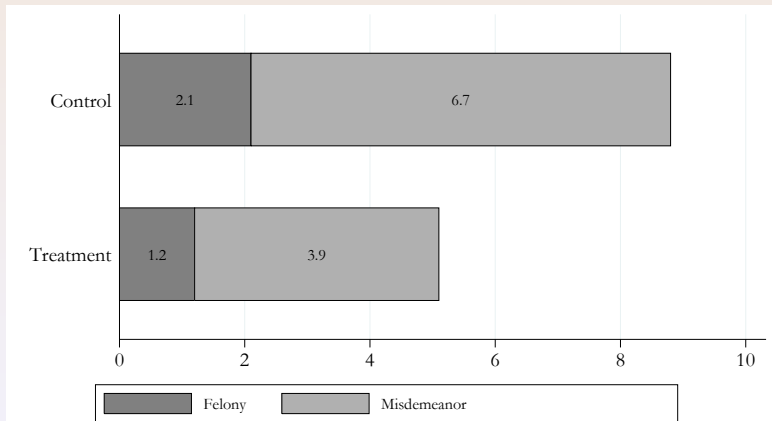


Perry preschool program: arrests per person before age 40, by treatment group



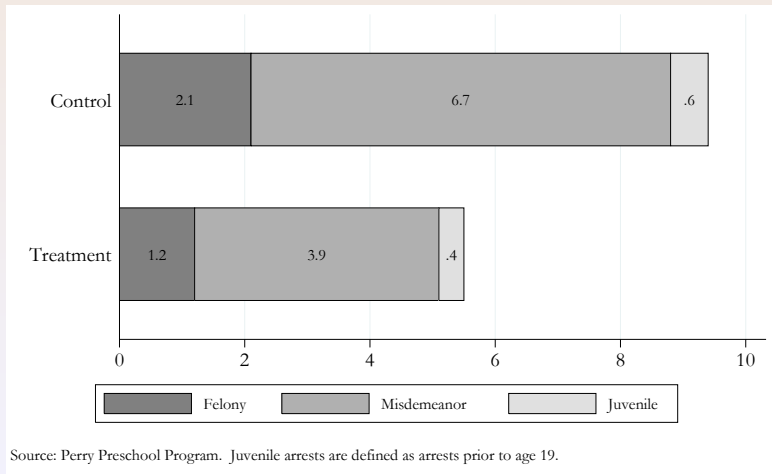
Source: Perry Preschool Program. Juvenile arrests are defined as arrests prior to age 19.

Perry preschool program: arrests per person before age 40, by treatment group



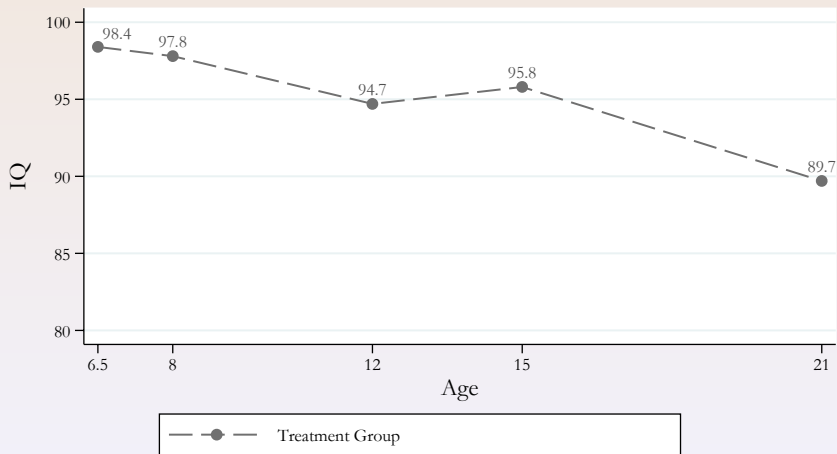
Source: Perry Preschool Program. Juvenile arrests are defined as arrests prior to age 19.

Perry preschool program: arrests per person before age 40, by treatment group



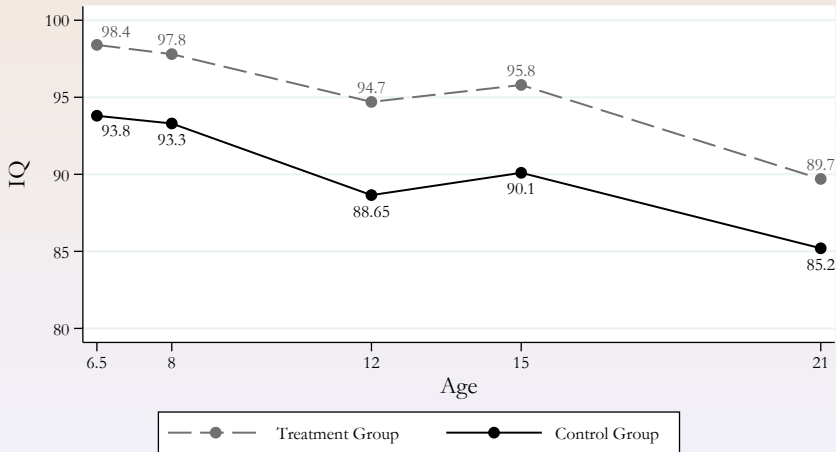
- Intervening more intensively at an early enough age can actually raise the IQ of the participants.
- In the more intensive, earlier starting Abecedarian program, IQ gains were found.

Abecedarian program: IQ, by age and treatment group



Source: Barnett (2004).

Abecedarian program: IQ, by age and treatment group



Source: Barnett (2004).

- The Nurse Family Partnership Act which intervenes with pregnant teenage mothers and teaches them mothering and infant care has strong effects on adult success.
- A consortium of scholars researching early childhood based at the Harris school at the University of Chicago is synthesizing and refining this evidence and conducting new experiments.
- The lesson is clear: the earlier the better and the more disadvantaged the child the more powerful effects of the intervention.

- Many studies have shown that improved cognitive and noncognitive skills produce high economic returns. An estimated rate of return (the return per dollar of cost) to the Perry Program is in excess of 10%.
- This high rate of return is much higher than standard returns on a stock market equity (7.2% in the U.S.) and suggests that society at large can benefit substantially from these kinds of interventions.
- These are underestimates of the rate of return because they ignore health and mental health.

Later Remediation is Costly

- What if we do not invest early, and let problems fester?
- At current levels of technology, remediation is ineffective. For example:
 - 1 Active labor market programs
 - 2 Class size reductions (reducing class size by five pupils per classroom)
 - 3 Adult literacy programs
 - 4 GED programs
 - 5 Public job training programs
 - 6 Tuition reduction policy

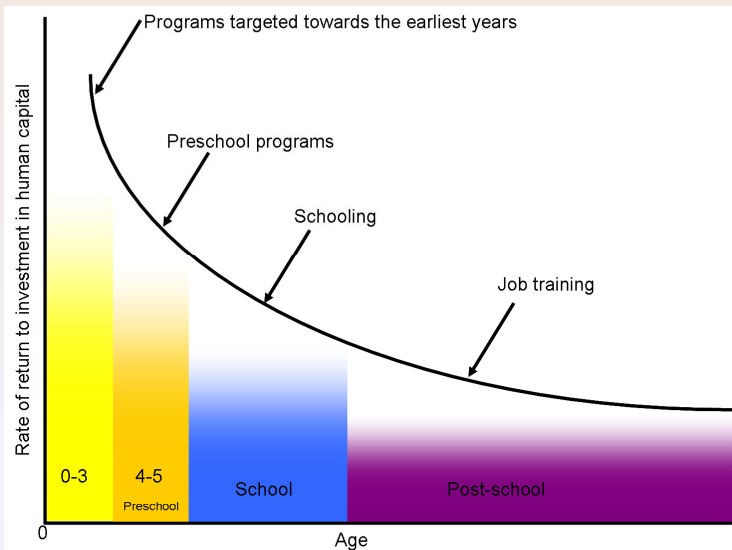
- To make these programs more effective, the programs would have to be greatly improved.
- At current levels of technology, they are ineffective.
- There is a substantial tradeoff between equity and efficiency for adolescent and young adult programs.
- A better alternative is to increase the investment in the early years and avoid the need for remediation.

- Several observations about the evidence from the available intervention studies at all ages are relevant.
- First, capabilities beget capabilities.
- All capabilities are built on a foundation of capacities that are developed earlier.
- Early learning confers value on acquired skills, which leads to self-reinforcing motivation to learn more and
- Early mastery of a range of cognitive, social, and emotional competencies makes learning at later ages more efficient and therefore easier and more likely to continue.

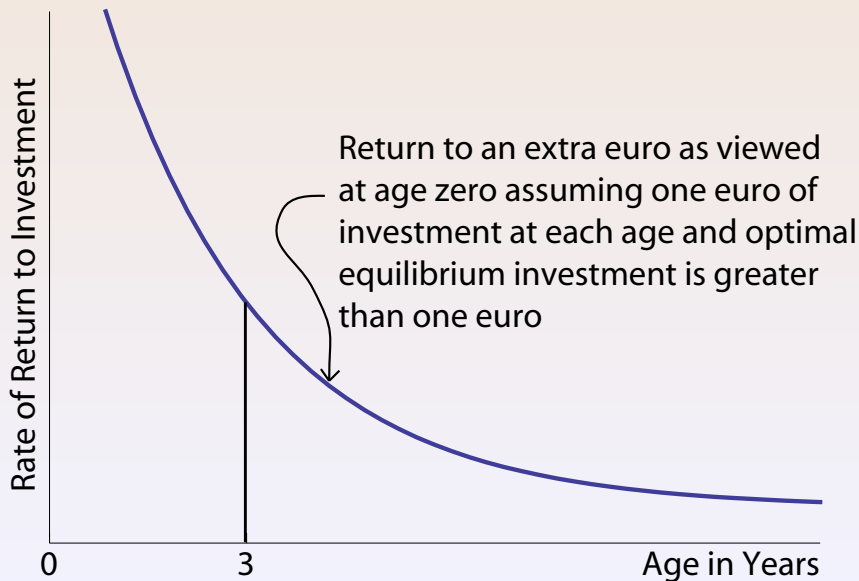
- Second, early intervention lowers the cost of later investment.

- The advantages gained from effective early interventions are sustained best when they are followed by continued high quality learning and socio-emotional experiences.
- The technology of skill formation as developed in Cunha and Heckman (2007) and Heckman (2007) shows that the returns on school investment are higher for persons with higher ability, where ability is formed in the early years.
- This figure shows the return at the *beginning* of life to a marginal increment in investment at different stages of the life cycle starting from a position of equal initial investment at all ages.

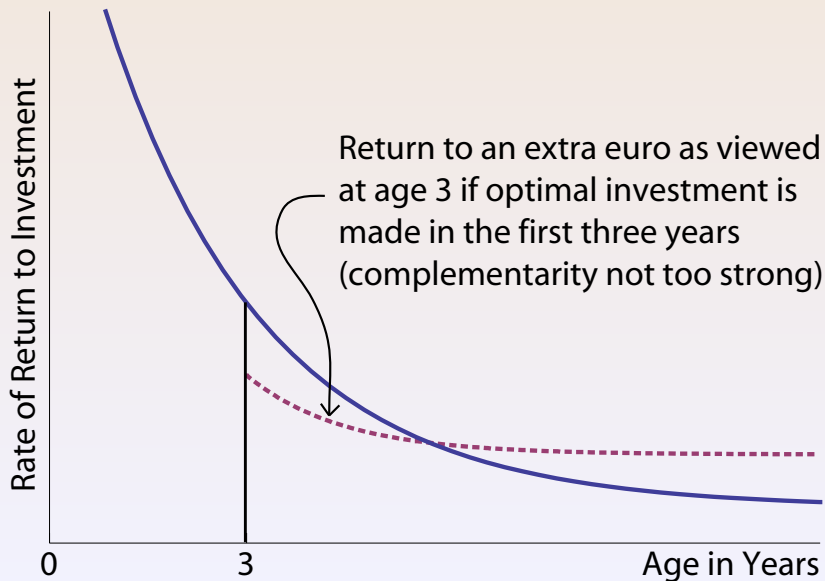
Return to a unit euro invested at different ages from the perspective of the beginning of life assuming one euro initially invested at each age



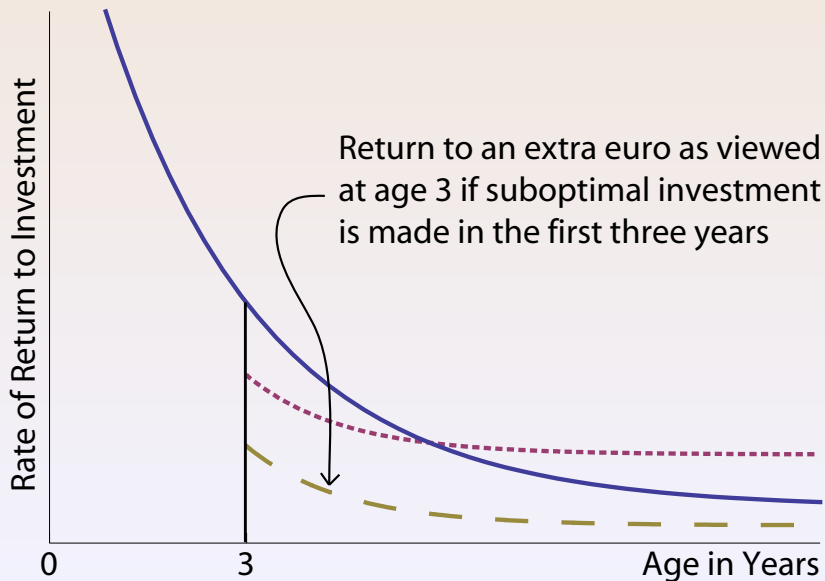
Returns to one more euro of investment as perceived at different ages initially and at age 3



Returns to one more euro of investment as perceived at different ages initially and at age 3



Returns to one more euro of investment as perceived at different ages initially and at age 3



- Early endowments and environments matter.
- But what happens later also matters.
- Remediation is costly.
- It is **not**, however, impossible, except when we get to very low levels of initial conditions.
- Resilience—“desistance”—is an important phenomenon.
- A new framework has been developed to incorporate these insights.
- Basis for unifying the literature and conducting policy analysis.

- Cunha and Heckman (2008) and Cunha, Heckman, and Schennach (2007) estimate technologies of skill formation to understand how the skills of the children evolve in response to
 - (1) the stock of skills children have already accumulated;
 - (2) the investments made by their parents; and
 - (3) the stock of skills accumulated by the parents themselves.

- C_t = cognitive skill at age t
- N_t = noncognitive skills at age t
- H_t = health at age t
- C_m = maternal cognition
- N_m = maternal noncognitive skills
- H_m = health of mother

- Technology for the production of cognitive skills:

$$C_{t+1} = F_{C,t}(N_t, C_t, H_t, I_t, C_M, N_M, H_m).$$

- Equation is a technology for the production of non-cognitive skills:

$$N_{t+1} = F_{N,t}(N_t, C_t, H_t, I_t, C_M, N_M, H_m).$$

- Equation for health skills:

$$H_{t+1} = F_{H,t}(N_t, C_t, H_t, I_t, C_M, N_M, H_m).$$

- These technologies recognize intergenerational transmission and dynamic multipliers.
- Captures the effect of critical and sensitive periods on development.
- Captures cross-effects of non-cognitive skills on fostering cognitive skills and vice versa.

Evidence from Early Interventions with Long Term Follow-up

- Consider two polar cases.
- One case: early and late investments are considered perfect substitutes (this is assumed in much economic analysis and public policy).
 - Early deficits can be perfectly remedied by later interventions.
- A second case, early investments critical for later investments to be effective.
 - Early deficits cannot be remedied.
- Neither case is correct, but the second is closer to the truth than the first.

- Use the estimated technology. (Cunha, Heckman and Schennach, 2006.)
- Consider the following target group based on Perry data.
- Children who are 6 years old, who come from a very disadvantaged background.
- They are at the bottom 10th percentile in the distribution of skills.
- They receive investments that are at the bottom 10th percentile in the distribution of investments.
- Mothers are also at 10th percentile in the distribution of skills.

Comparison of different investment strategies. Disadvantaged Children: First decile in the distribution of cognitive and non-cognitive skills at age 6. Mothers are in first decile in the distribution of cognitive and non-cognitive skills at ages 14-21.

Outcome	Baseline	Changing early conditions: changing investment from the 1 st to 4 th decile of distribution of early investment	Adolescent intervention: moving investments at last transition from 1 st to 9 th decile	Changing initial conditions and performing a balanced intervention using the resources of the adolescent intervention
High School Graduation	0.4109	0.6579	0.6391	0.9135
Enrollment in College	0.0448	0.1264	0.1165	0.3755
Conviction	0.2276	0.1710	0.1773	0.1083
Probation	0.2152	0.1487	0.1562	0.0815
Welfare	0.1767	0.0905	0.0968	0.0259
			40% more costly	

Source: Cunha and Heckman (2006).

- The evidence strongly supports the economic efficiency of early initial investment that is sustained.
- Optimal distribution of investment:
 - Invest early? Yes.
 - But must be followed up to be effective.
- This is a consequence of dynamic complementarity.
- Later remediation is possible but to attain what is accomplished by early investment is much more costly (40%).
- If we start at too low a level, later skill investment is economically inefficient.

Practical Issues

- A. Whom to target?
- B. With what programs?
- C. Who should provide the programs?
- D. Who should pay for them?
- E. Issues of compliance.

Whom to target?

- i. Returns highest for disadvantaged who do not get substantial early investment.
- ii. What is the proper measure of disadvantage? Is it poverty? Measures of childhood home life?
- iii. Evidence suggests that the quality of *parenting* is the key.
- iv. *Parenting* is the scarce resource.
- v. Not always closely linked to family income or even parental education.

With what programs?

- i. Programs that target the early years seem to have the greatest promise.
- ii. Nurse Family Partnership Program / Abecedarian / Perry
- iii. Home visits affect the lives of the parents, create a permanent change in the home environment.
- iv. Programs that build character and motivation — not just cognition — are the most effective.

Who should provide the programs?

- i. Respect the sanctity of early family life.
- ii. Respect cultural diversity.
- iii. Create a base of common skills and traits but do so within culturally diverse settings.
- iv. Engage private industry and other social groups that
 - a. Draw in private resources.
 - b. Create community support.
 - c. Represent diverse points of view.

Who should pay for them?

- i. Can make programs universal to avoid stigmatization.
- ii. Offer a sliding fee schedule to avoid deadweight losses.
- iii. Mobilize private resources to support the subsidy.

Issues of compliance.

- i. Many successful programs change the values and motivation of the child.
- ii. This may run counter to the values of parents.
- iii. There may be serious tension between the need of child and the acceptance of intervention by the parent.
- iv. Then there is a basic conflict between values of society (as it seeks to develop the potential of the child) and the values of the family.

Summary

- About 50% of the variance in the lifetime inequality in earnings are determined by age 18.
- The other 50% is determined later, after family influence wanes.
- Many countries are facing a slowdown in the production of skills.
- Family environments play a powerful role in shaping abilities.
- Growing inequality and a growing underclass of the young neither working nor attending school.
- Many current social problems have their roots in ability deficits.
- Abilities are multiple in nature — more than IQ matters in determining socioeconomic success.
- Ability deficits powerfully determine educational attainment and many other outcomes.

- Education is an independent determinant of economic and social success.
- An educated workforce is essential for Europe to survive and prosper.
- Ability deficits open up early in life and persist.

Summary

- Noncognitive traits stimulate production of cognitive traits (cross complementarity).
- Accords with evidence from a variety of studies.
- Remedial investment is possible but less efficient — consistent with the evidence from neuroscience.
- Later investment is more efficient if early investment is made.

Summary

- Balanced portfolio weighted toward the early years is optimal.
- For the disadvantaged population, current expenditure is weighted toward the later years (remedial programs).
- Early investments targeted toward the disadvantaged are effective; have high rates of return.
- Early investments create a base for later investment.

Summary

- Later remedial investments have much lower returns.
- Europe currently overinvests in social programs with low returns targeted toward the old.
- All of the evidence points to investing more in the early years.
- Redistribute funds from the old to the young; shift expenditure from ALMP policies to early childhood programs.