

# Intergenerational Human Capital Transmission

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Diego Daruich

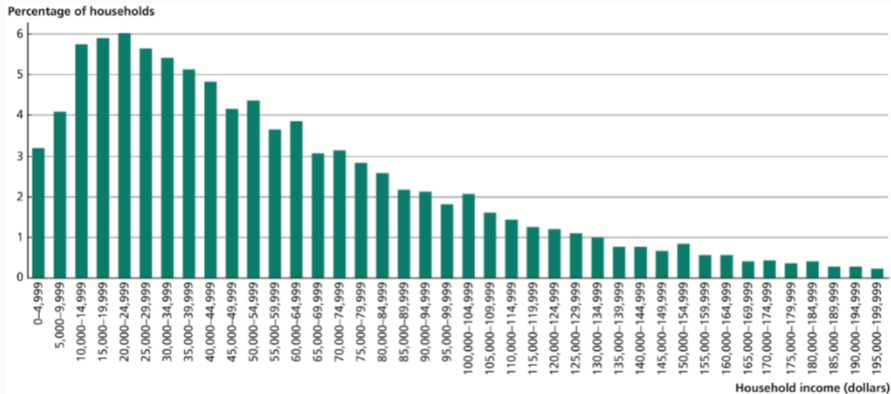
Federal Reserve Bank of St. Louis

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*The views expressed on this presentation do not necessarily reflect the positions of the Federal Reserve Bank of St. Louis or the Federal Reserve System.*

# Inequality

## Distribution of Household Income



Source: DeNavas-Walt, Proctor and Smith (2010).

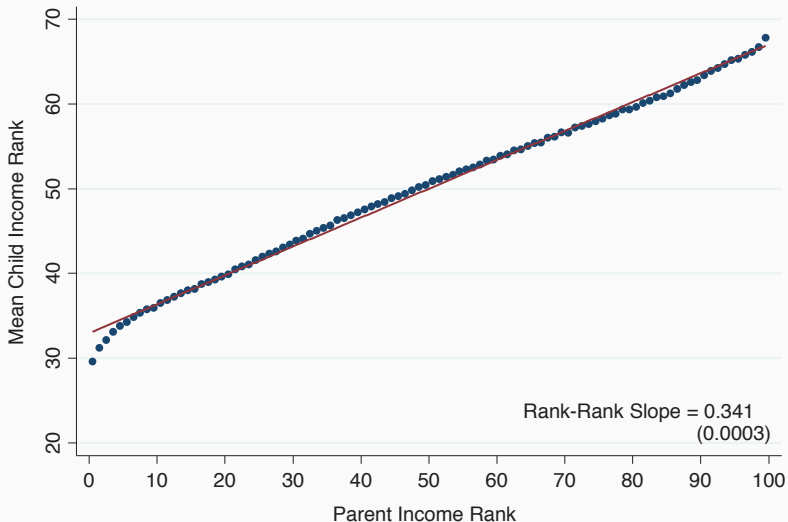
# How is inequality emerging?

## Two extreme alternatives:

- Opportunities are equally distributed but individuals put different effort
- Opportunities are unequally distributed from very early on in life

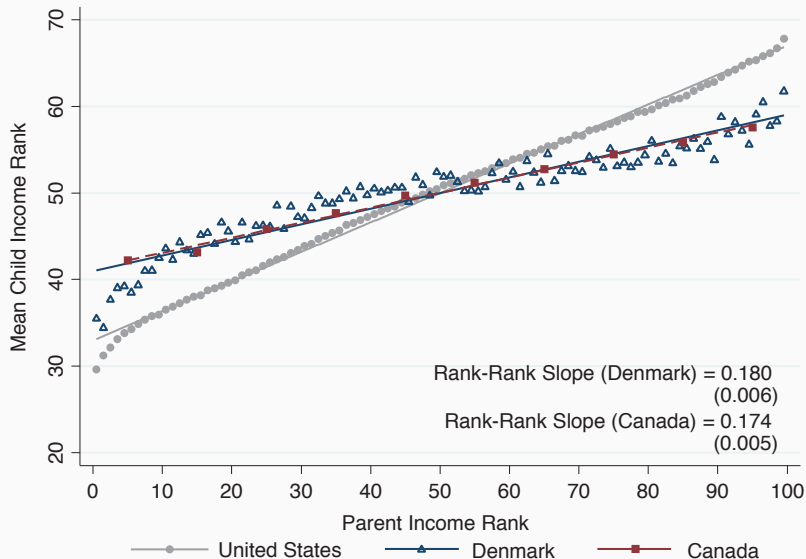
# Intergenerational mobility of earnings (Chetty et al, 2014)

A. Mean Child Income Rank vs. Parent Income Rank in the U.S.



# Intergenerational mobility of earnings (Chetty et al, 2014)

## B. Cross-Country Comparisons



# Human capital persistence

## How persistent is human capital across generations?

Two typical measures of human capital:

- Education
- Skills (test scores)

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Two typical measures of human capital:

- **Education**
- Skills (test scores)

# Education persistence

## Mulligan (1999) average of 8 estimates

- Correlation of years of schooling is 0.29 in the US

## Probability of graduating college (PSID):

- Over 50% for children of college graduates
- Under 20% for other children



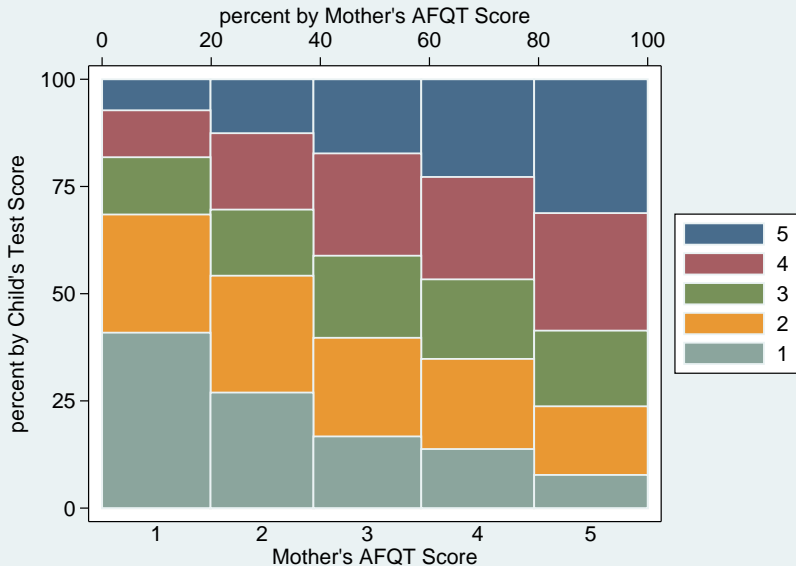
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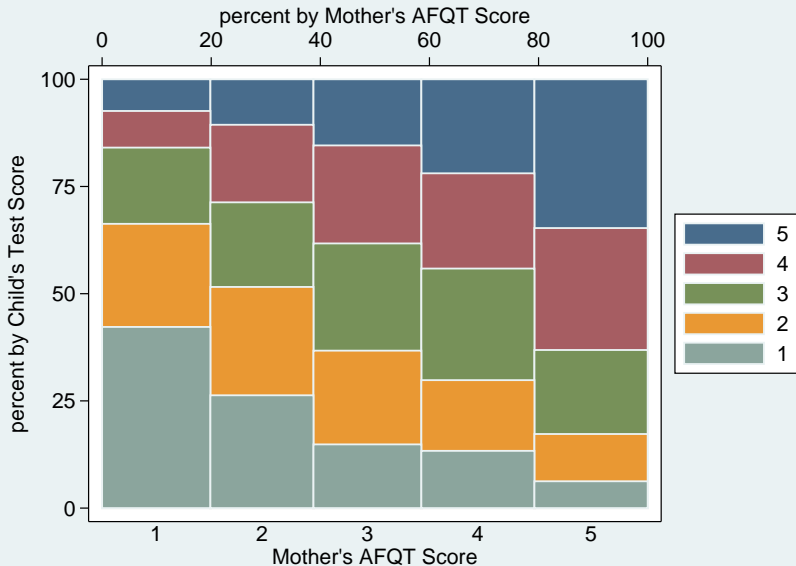
Two typical measures of human capital:

- Education
- **Skills (test scores)**

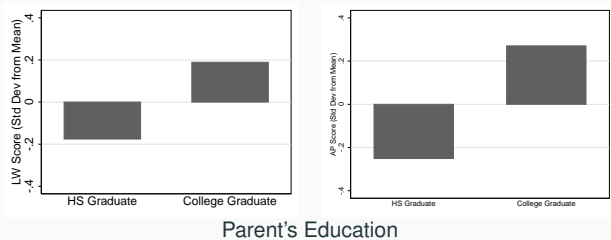
# Skills persistence: Reading Test (NLSY79)



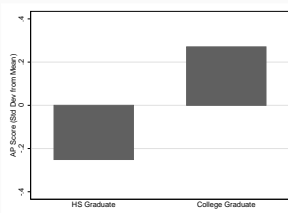
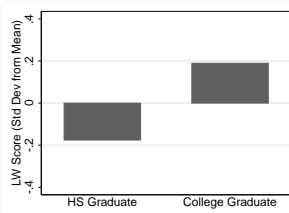
# Skills persistence: Math Test (NLSY79)



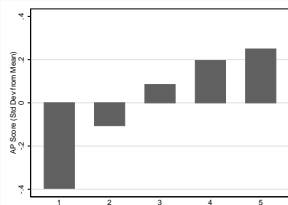
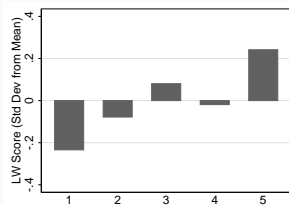
# Skills persistence (PSID-CDS)



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Parent's Education



Parent's Permanent Income (Quintile)

**Notes:** Score trend by age is removed. Average test score is used for each individual. Income: calculated using all family income while child's age < 12. **Source:** PSID + CDS.

# Outline

Sources of inequality

Large-Scale Policy Implications

# Sources of inequality (Hugget, Ventura and Yaron, 2011)

## Study sources of inequality using a risky human capital model

- **Three “initial conditions” (at age 23):**
  - Initial human capital
  - Learning ability
  - Financial wealth
- **Versus labor shocks (e.g., wage shocks and effort)**

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## But...

*“This article is silent on the prior forces which shape the individual differences that we analyze at age 23”*

# “Initial conditions”

## What factors determine “initial conditions”?

- Human Capital
  - Skills (which?), ability to learn, education
- Assets
- Networks
- Health
- ...

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# What determines human capital?

## Standard elements that determine human capital

*A combination of endowed abilities, environment and investments interacting in (likely very) complicated ways*

- **Initial draw**

- What is the initial age?

- **Production function of human capital**

- How does human capital change over life?

- **Investments**

- Parental and government investments
- Adult education, experience, and on-the-job learning
- Return to investments

- **Environment**

- Peer group effects
- Neighborhood effects

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## It is hard to measure skills at birth or genetics (and their importance)

*What % of outcome variation can be accounted for by genetic variation?*

- **Twin Studies:**

- Compare within-pair correlations of identical twins and fraternal twins
- Branigan et al (2013): 40% of education variation explained by genetic factors

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- Limitation: Adopting process takes time, so child spends many (important) months either with genetic parents or in orphanage
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*Neither of them allows for interaction between pre-birth and environment*



- **Using data on genetic factors and education/labor outcomes**
  - Only very recent literature
  - Papageorge and Thom (2018)
    - 10% of education variation related to genes variation
    - Controlling for parental education reduces gene-education association
  - But interaction with childhood environment seems key
    - Gene-college association is stronger for high SES children
    - Gene-HS association is smaller for high SES children

**Note that causality is not claimed by any of these studies**

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# Production Function of Human Capital

## Cunha, Heckman, Schennach (2010)

- Pre-natal environment is hard to distinguish from genetics
- Instead: How malleable are skills to investments at different ages?
- **Estimate production function of skills**

$$\underbrace{\theta'_k}_{\text{Next period child's skills}} = \left[ \alpha_{1j} \underbrace{\theta_k^{\rho_j}}_{\text{Current child's skills}} + \alpha_{2j} \underbrace{\theta^{\rho_j}}_{\text{Parent's skills}} + \alpha_{3j} \underbrace{I^{\rho_j}}_{\text{Parental investments}} \right]^{1/\rho_j} \exp(\nu)$$

- Endogeneity concerns: use instrumental variables
- **Results**
  - Find 0.2 correlation between parents' skills and children's skills at birth
  - More importantly: Skills are malleable, particularly early on

# What determines human capital?

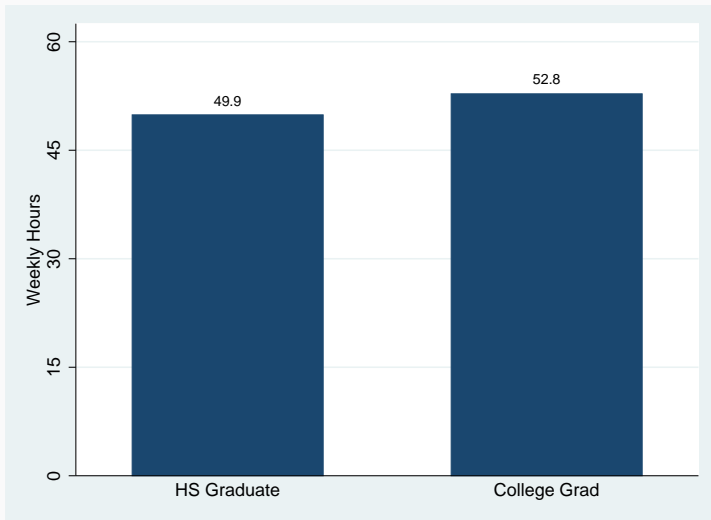
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## Active time with parents

- Using time diaries I calculate “active” time with parents.
- “Active:” parent is performing activity with kid.  
Assumption: If two parents are active, double the hours.

## Active time with parents: by mother's education



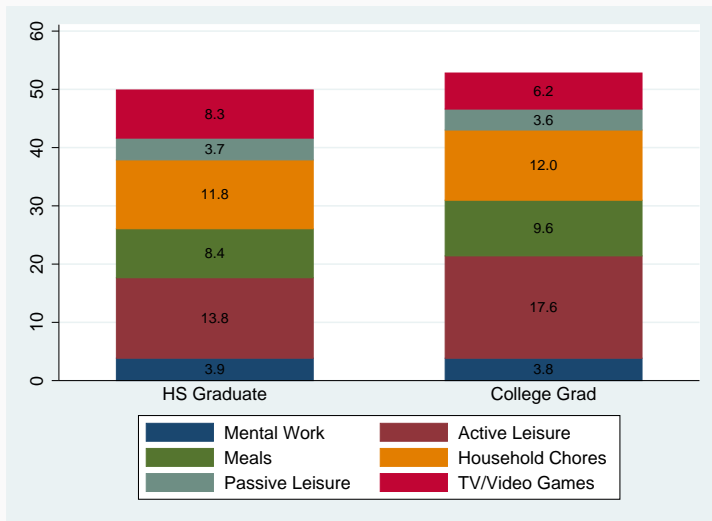
**Notes:** Time trend by age is removed. Average for each child is approximated for age 4.

**Source:** PSID + CDS.

## Active time with parents: Categories definitions

- **Mental Work:** Homework, computer work, museums, reading (and being read to), conversations, and letters.
- **Active Leisure:** Volunteering, religious practice, child/family organizations, entertainment, playing games, sports, other computer.
- **Meals:** at home or away.
- **Household chores:** Household activities (cooking, laundry,...), caring for other children, shopping, care to self and others (e.g., showering, dressing).
- **Passive Leisure:** Radio, music, phone, “laying around”...
- **TV/Video Games.**

# Active time with parents: by mother's education

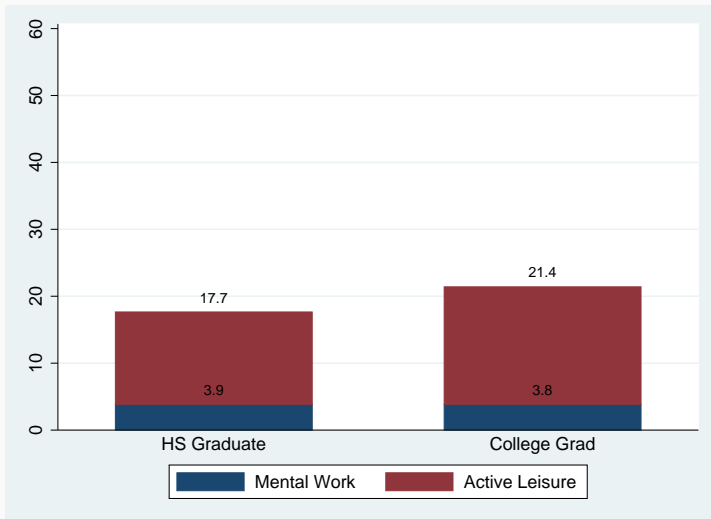


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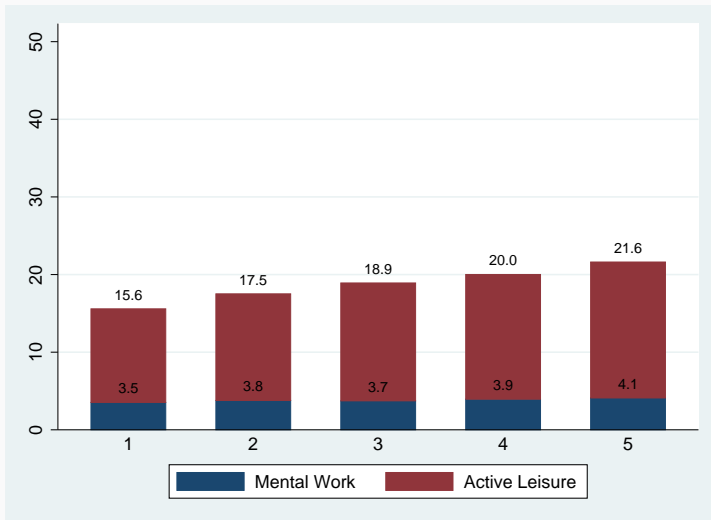


# Active time with parents: by income



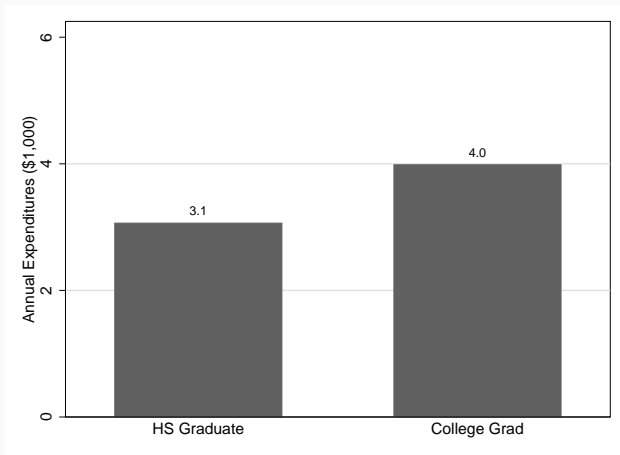
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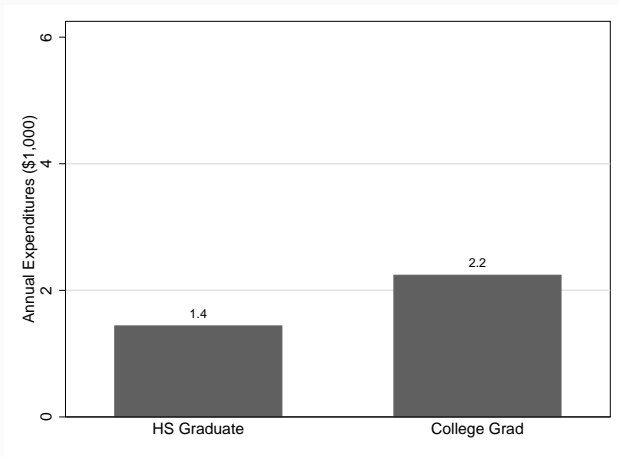
# Monetary expenditures on child: by mother's education



Parent's Permanent Income (Quintile)

Includes toys, vacation, school supplies, clothes, food, and medical. Expenditures trend by age is removed. Average for each child is approximated for age 4. **Source:** PSID + CDS.

## Rent (per room) expenditures: by mother's education

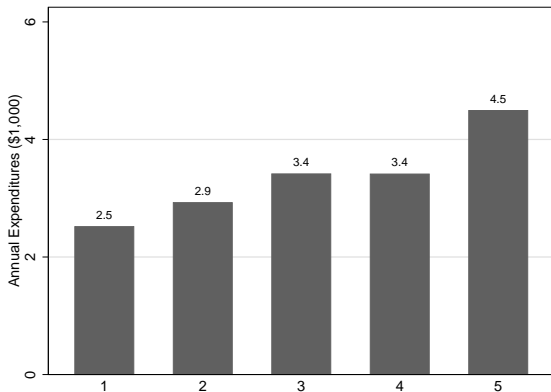


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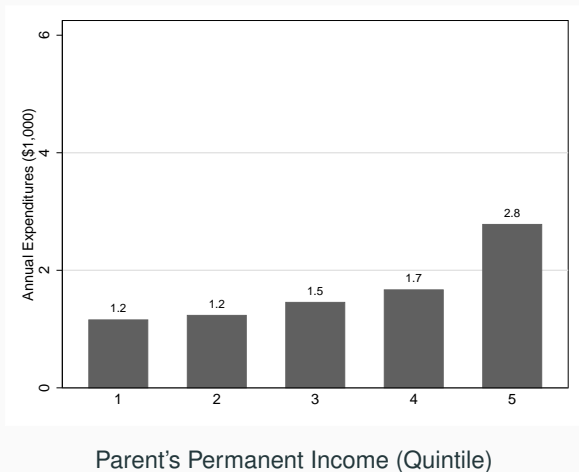
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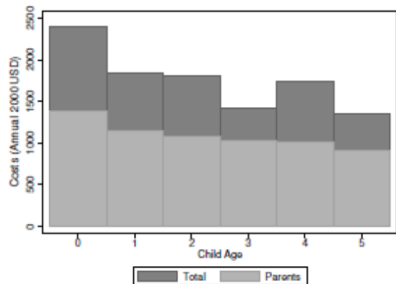
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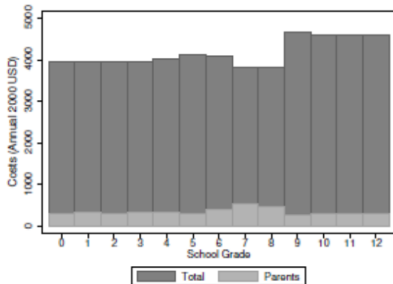
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# Government Investments by Children's Age

## Government vs. Parental Investments as children grow older



(a) Daycare costs

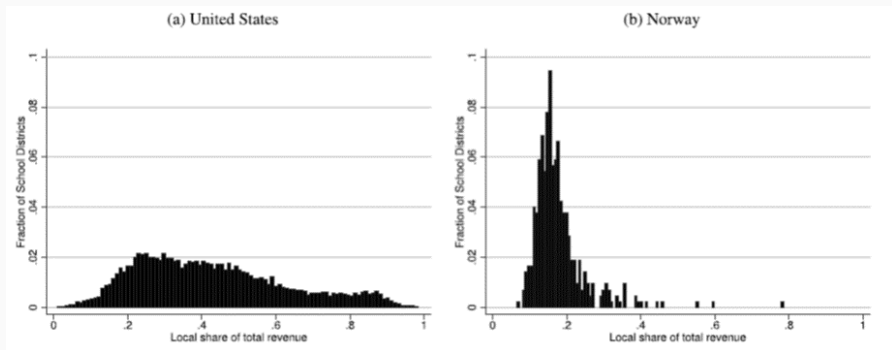


(b) Schooling costs



# Government Investments Heterogeneity by Districts

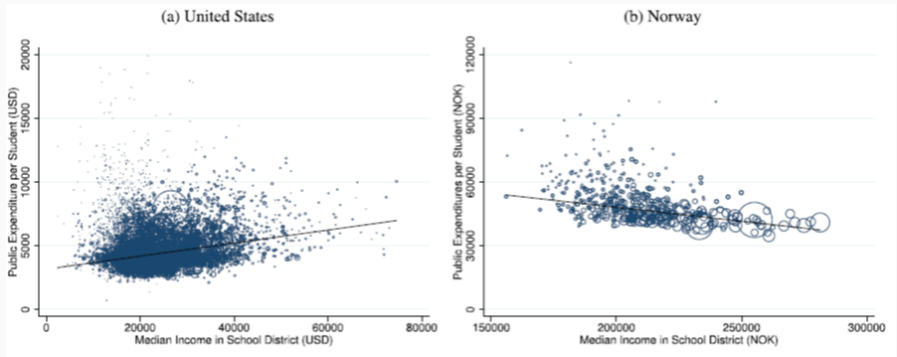
US Government investments vary substantially by school district



Source: Herrington (2015).

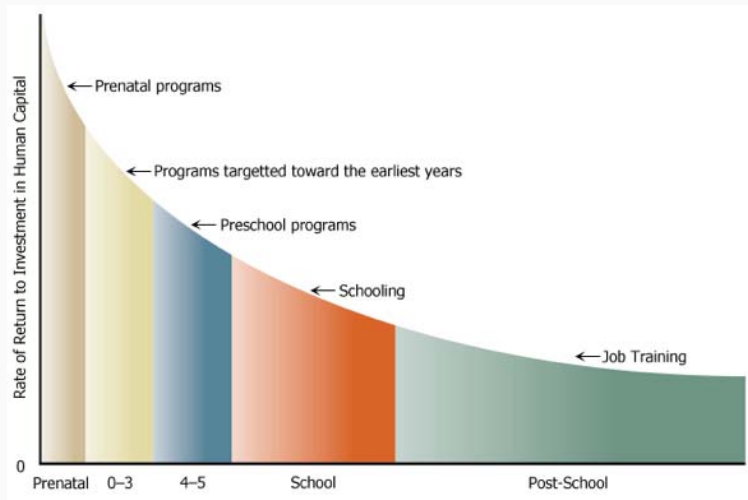
# Government Investments and Median Income by Districts

...and are related to income in the district



Source: Herrington (2015).

# Returns to investment at different ages (Heckman, 2008)



# Early childhood development programs

**Programs start with kids as young as a few weeks old**

## **Typical goals:**

- Support language, motor, and cognitive development
- Minimize high-risk behaviors
- Develop socio-emotional competencies

## **Large variation in program quality:**

- Important to distinguish child-care from early childhood development
- High-quality programs:
  - Low child-caregiver ratios
  - Emphasize active learning experiences and one-on-one interactions
  - Prepare for classroom experience

# Evaluating the Impact Of Education Programs

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## **Example:**

- Suppose rich parents are more likely to send children to school
- And rich parents also spend more time with children
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- And rich parents also spend more time with children
- Simple regression would mix the benefit of the time with the benefit of the program

## **Another example:**

- If returns are heterogenous and only some people gain from programs
- People choose to participate so only the ones gaining participate
- Simple regression would be biased by selection issues

# Randomized Controlled Trial (RCT)

## Randomized Controlled Trial (RCT) methodology

- Randomly divide people into treatment and control group
- Treatment group is “intervened” by some policy (e.g., free education)
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(e.g., just differences in average outcomes)

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## Disadvantages:

- Can be very expensive
- Results are specific to population studied
- Mechanisms of causation are not clear
- Does the control group compensate for not being intervened?

## Use RCT to estimate impact of early childhood program

### Garcia, Heckman, Leaf, and Prados (2017):

- Early childhood program in 1970s, targeting disadvantaged kids
- Cost  $\approx$  \$20k per year for 5 years, i.e., total \$100k per child
- Followed up into adulthood and observe education/income

# Abecedarian Program

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### Results:

- College graduation rates grow by 13p.p. (about double of control group)
- Lifetime earnings (in NPV) grow by \$1.3 for every dollar invested
- Many other gains: health, crime reduction, parental income...
  - Total returns can be as high as \$7 for every dollar invested

## Teach parents how to interact with children

### Jamaican Study — RCT evidence

- Enrolled disadvantaged kids between 9 and 24 months old in 1980s
- 2 years of weekly 1-hour play sessions at home
- Improving the quality of the interaction between mother and child

### Followed 20 years after and compare to control group

- Large increase in income (15–25%)
- Enough to catch-up to non-disadvantaged kids

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# Peers and Neighborhood effects

## Need to separate neighborhood effect from parental characteristics

### Moving to Opportunity Program (1990s)

- Target: randomly selected families in high-poverty housing projects
- Intervention: vouchers to move to lower poverty neighborhoods

### Results

- Small effect on parents and older children
- Children who move before age 13: Income increased by 31%
- Income gains are estimated to be around \$100k per child

# Outline

Sources of inequality

Large-Scale Policy Implications



# From Empirical Evidence to Large-Scale Policies

## Early childhood investments increase education and income

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## Consequences of *large-scale* and *long-run* policy depend on

- Crowding out effects (particularly on high-income groups)
- GE effects on capital and labor markets
- Deadweight loss of raising taxes
- Intergenerational dynamics

## What is the impact of a *permanent and universal* early childhood government investment policy?

Particularly on: income, inequality, intergenerational mobility, and welfare

Use an overlapping generations (OLG) model

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**Macro Model**

- Wage depends on **skills**

+

**Endogenous Intergenerational Links**

- **Parental investments of time and money to build child's skills**

- **Potential role for government investments because of:**
  - Imperfect capital and insurance markets
  - Inability to write contracts with children

# Skill Development in the Model

## How are skills produced?

$$\underbrace{\theta'_k}_{\text{Next period child's skills}} = \left[ \alpha_{1j} \underbrace{\theta_k^{\rho_j}}_{\text{Current child's skills}} + \alpha_{2j} \underbrace{\theta^{\rho_j}}_{\text{Parent's skills}} + \alpha_{3j} \underbrace{l^{\rho_j}}_{\text{Parental investments}} \right]^{1/\rho_j} \exp(\nu), \nu \sim N(0, \sigma_{j,\nu})$$

$$l = \bar{A} \left[ \alpha_m \underbrace{(m + g)^\gamma}_{\text{Money}} + (1 - \alpha_m) \underbrace{t^\gamma}_{\text{Time}} \right]^{1/\gamma}$$

## Key Mechanism

- Parents invest time  $t$  and money  $m$  to develop kid's skills  $\theta_k$
- Government invests  $g$  (paid by higher taxes)
  - Can increase kids skills
  - But can crowd out parental investments  $\Rightarrow$  Parents reduce investments
  - and distorts labor choices  $\Rightarrow$  High-skilled want to work less

# Role for government intervention

## Why is there a role for government intervention $g$ ?

### **This paper: Incomplete Markets**

- Borrowing constraints
  - Poor parents cannot afford the investments, even if very profitable
- Lack of insurance
  - Cannot insure against risk of investing in child

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### Other ideas to explore

- Parents don't know the production function
- Parents are heterogeneous in altruism
  - Together with some market incompleteness

# Results

## Large long-run effects

- **Average income** grows by 8%
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## Investing in a child today will make him a better parent tomorrow

- **Transition**: Large increase in gains after first generation has its own children

## Who does not benefit from the reform?

- Older individuals at the time the policy is introduced
- But this depends on how the transition is financed

# Main takeaway

## Large intergenerational persistence in the data

- In education, skills, income...

## Human capital seems to play a large role in inequality

- Early investments are found to be particularly important
- Empirical evidence suggests government intervention can be beneficial

## We can use models to extrapolate from specific empirical evidence

- Need to make assumptions
- Models can complement empirical studies