How to close the skill gap?

Parental Background and Children's Skill Development in Indonesia

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Motivation

- Parental investments are an important determinant of human capital
- In the context of developing countries, not only education, but also nutrition investments play a role

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- Parental investments are an important determinant of human capital
- In the context of developing countries, not only education, but also nutrition investments play a role
- In these countries, financial constraints make it difficult to invest, especially for poorer households

→ 20% of children under age 5 have extremely low height-for-age

→ 53% of children unable to understand a simple text by age 10

→ In Indonesia, 43% cannot perform one-digit multiplication by the end of 3rd grade

Motivation

Development policies can be used to increase children's skills

$\Downarrow$

Parents play important role as they decide on investment inputs for their children

$\Downarrow$

Understanding parental investment decisions is fundamental to design effective policies

$\Rightarrow$ I quantitatively evaluate effects of different policies taking into account parents' decisions

This paper

1. I model parental investment decisions in low/middle income country setting
   - Parents get utility from their children's skills and consumption
   - They decide on investment in children: nutrition and schooling expenditure
     → subject to financial constraints
   - Children's skill dynamically accumulate in multi-period skill production function
     → parental characteristics influence skill production

LMIC Indonesia data literature

This paper

2. I structurally estimate the model using panel data from Indonesia (IFLS, 1993-2014)
   - Long panel
     → childhood stages modelled: early childhood to adulthood
   - Measurements of schooling expenditure and nutrition (food diversity)
   - Measurements of skills (math, logic and language test scores)
     → allows to identify cognitive skills
3. I simulate the impact of policies: nutrition and schooling subsidies, and cash transfers

LMIC Indonesia data

Contribution to the literature

- Role of nutrition in child development

  Hoddinott et al. (2008), Belot and James (2011), Sánchez (2017), Lee et al. (2018), Aurino et al. (2020), Bailey et al. (2020), Behrman et al. (2020), Filmer et al. (2021)

  → I use a structural model which allows me to include parents' investment decisions and reactions to policies

  → I can estimate the complementarity of schooling and nutrition

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- Dynamic models of skill formation

  Cunha and Heckman (2008), Cunha et al. (2010), Villa (2017), Attanasio et al. (2017, 2020a,b)

  → I model endogeneous parental investment choices

Contribution to the literature

- Models of skill formation with endogenous parental choices

  Todd and Wolpin (2007), Bernal (2008), Del Boca et al. (2014), Daruich (2018), Lee and Seshadri (2019), Caucutt et al. (2020)

  → I model nutrition as investment input

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  → I model nutrition as investment input

- Evaluations of child development policies in low- and middle-income countries

  Duflo (2001), Todd and Wolpin (2006), Macours et al. (2012), Krishnamurthy et al. (2017), Kaul (2018), Cahyadi et al. (2020), Ashraf et al. (2020), Bobba et al. (2021)

  → I conduct ex-ante policy evaluation and test for dynamic complementaries

Data: Indonesian family life survey

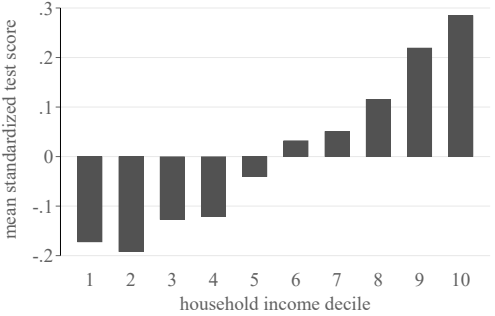
- Panel survey with 7,200 households (1993, 1997, 2000, 2007, 2014)
- Representative of 83% of Indonesian population
- Data on children's outcomes: height, weight, math, logic and language test scores
- Investment measures:
  - Food groups consumed (staples, proteins, fruits, vegetables, dairy)
  - Schooling expenditure (fees, books, transport, special courses, uniform, food)

→ 43.6% of population lives with less than $2.15 a day in 2000

→ 42.4% of children under age 5 display extremely low height-for-age in 2000

data

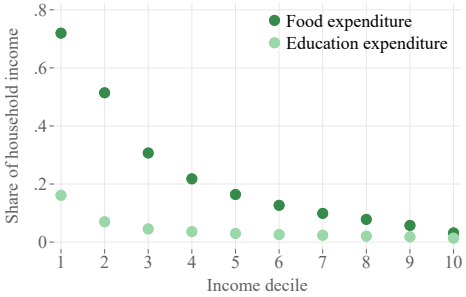
Figure: Mean standardized test scores by household income decile in Indonesia



→ Persistent skill gap by income

investments by education

Figure: Investments as shares of household income



Note: Data from Indonesian family life survey. Household income adjusted by household size.

→ Higher income households spend lower share of income on investments and have lower share of nutrition investments

Model set-up:

- 3 childhood stages $t \in \{1, 2, 3\}$
- Parents divided into 3 education groups

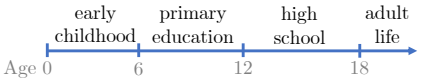


Figure: Model stages

details

Model set-up:

- 3 childhood stages $t \in \{1, 2, 3\}$
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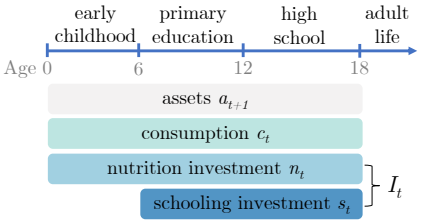
- Choices: consumption, assets and child investments
- Investments I_t are composed of nutrition n_t and schooling s_t



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household budget

Figure: Exemplary model period

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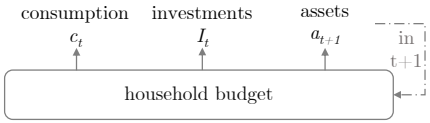

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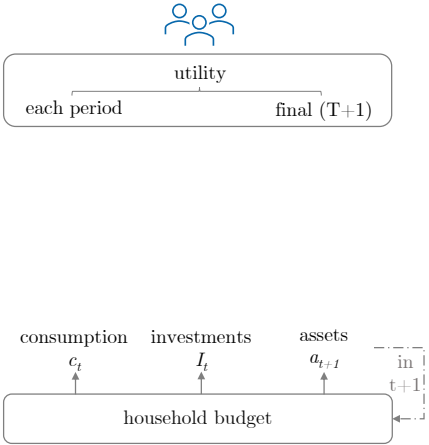

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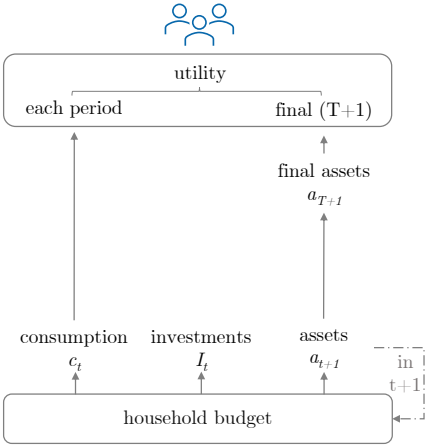

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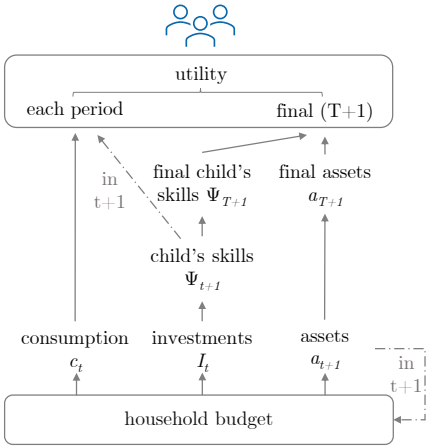

Figure: Exemplary model period

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Socioeconomic status influences choices via:

- preferences for skills
- household income and assets
- skill formation (differences in productivity)

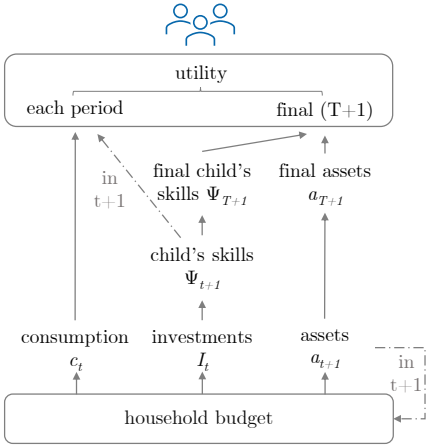

Figure: Exemplary model period

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Skill formation:

- investments:
  nutrition + schooling
  → substitutes or complements?
- future skills:
  investments + skills
  → timing
- productivity of inputs varies by parental education and parenting skill type

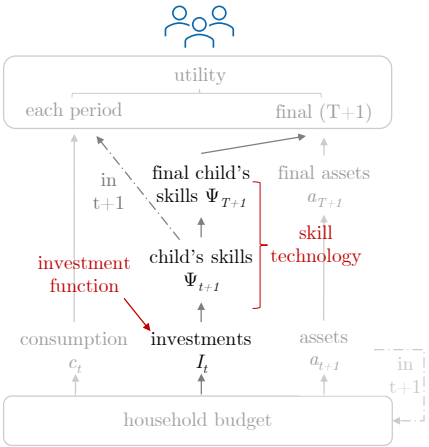

Figure: Exemplary model period

details

Overview estimation

Parameters	Strategy
Outside of the model:	
Annual discount factor	Dutu (2016): 0.98
Unobserved parenting skill types	Bonhomme et al. (2022): k-means clustering
Household income	OLS prediction
Structural model:	
Investment function parameters	Estimation by joint GMM
Skill production function parameters	→ Inv → HC
Preference parameters	Simulated method of moments

model types types results

Estimation of dynamic structural model

Step 1: Parameters of children's skill formation (generalized method of moments)

- Regional and time variation in food prices: substitutability of investments
- Variation in investment levels and skills across periods and children: impact of parental characteristics and investment by period
- Two measures for cognitive skills: accounting for measurement error

results summary details fit

Estimation of dynamic structural model

Step 1: Parameters of children's skill formation (generalized method of moments)

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Step 2: Preference parameters (simulated method of moments)

- Estimated using model solution for investments and assets

results summary details fit

Summary of estimation results

1. How does higher parental education impact skill development?
   - Parents produce higher future skills with same level of inputs
   - They are more effective in using schooling inputs
     → Spend larger share of their investments on schooling
   - They value cognitive skills less
     → Parents mainly constrained by budget and productivity
2. Are nutrition and schooling complements or substitutes?
   - Complements, with higher complementarity in high school
     → parents react to price decreases with increasing both inputs

estimation fit decomposition

Policy scenarios

1. Nutrition price subsidy (20%)
2. Schooling price subsidy (99%)
3. Unconditional cash transfer (3% of mean income)

→ Implemented for lowest 20% of income distribution

→ Implemented at primary and high school stage

→ Simulated to be cost-equivalent

summary results table inequality combinations

Policy scenarios - results

1. Nutrition price subsidy (20%) ↑ **0.04 SD**
2. Schooling price subsidy (99%) ↑ 0.03 SD
3. Unconditional cash transfer (3% of mean income) ↑↓ negligible effects

→ Implemented for lowest 20% of income distribution

→ Implemented at primary and high school stage

→ Simulated to be cost-equivalent

summary results table inequality combinations

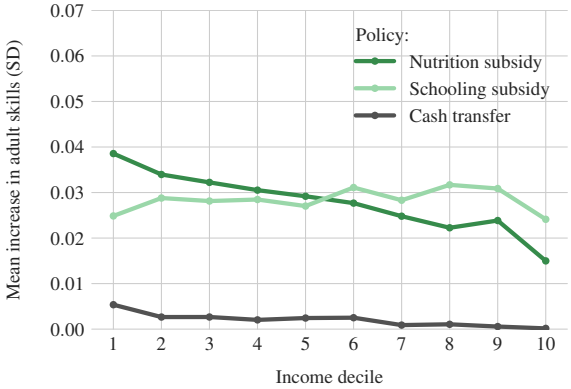
Inequality reduction of policies

Can nutrition subsidies decrease inequality? If so, why?

→ Simulate polices for each household income decile:

1. Nutrition price subsidy (20%)
2. Schooling price subsidy (99%)
3. Unconditional cash transfer (3% of mean income of lowest 20%)

Figure: Policy impacts by income decile



→ Effect of cash transfer and nutrition subsidy decreases with income

→ Nutrition subsidy most effective to reduce skill gap

investments table

Mechanism

- Nutrition subsidies can reduce inequality

Low income parents spend higher share on nutrition investments
(lower productivity of schooling)
⇓
React stronger to nutrition price changes
⇓
Increase both inputs (complements)
⇓
Adult cognitive skills ↑

- More cost-effective to implement nutrition subsidy alone instead of splitting costs and combine policies

details combinations

Recap

- In this paper:
  - I estimate a dynamic structural model of skill formation with endogenous investment decisions in schooling and nutrition
  - I decompose the skill gap by socioeconomic status in Indonesia
  - I simulate long-run impacts of cash transfers, nutrition and schooling subsidies on cognitive skills
- Main finding:
  - Nutrition subsidy: $\uparrow$ 0.04 SD in adult skills
  - Schooling subsidy: $\uparrow$ 0.03 SD in adult skills
  - Nutrition subsidies more cost-effective than splitting the budget into two policies

Thank you!

If you have any further feedback, please feel free to contact me!

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