Large-scale school meal programs and student health: Evidence from rural China

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Abstract

This paper evaluates the impact of a large-scale school meal program on student health and nutrition status in rural China. We use data from multiple rounds of the China Health and Nutrition Survey (CHNS) and implement a quasi-experimental approach exploiting cross-county variations in program implementation. We find that program participation is, on average, associated with a higher height-for-age z-score (HAZ) in the order of 0.2-0.4 standard deviations, although the effect does not translate into a lower stunting rate. The effect seems larger on students with an initial higher HAZ score and on girls than boys. We do not find significant effects on the Body Mass Index BMI-for-age (BMIz) and weight-for-age (WAZ) z-scores. The results are robust to alternative estimation methods and different samples.

Motivation

- Malnutrition is one of the most serious challenges faced by developing countries
  - ✓ In 2019, around 149 million children were stunted (low height-for-age) [1], which not only serves as a marker for unrealized physical and cognitive potential but further signals likely difficulties in school learning and failure to accumulate sufficient human capital.
- Several countries have implemented national school feeding programs (SFP) with the aim to improve children's health and nutrition, and SFPs have become one of the most important social protection programs worldwide.
- We examine the impacts of a large-scale school meal program, Nutritional Improvement Program (NIP), on students in rural areas in China.
  - ✓ The stunting rate of children <5 years old is more than four times larger in poor rural areas compared to urban areas (18.7% versus is 4.3%). [2]
  - ✓ Special attention to HAZ as a low height-for-age is a chronic condition and it is an indicator of overall nutritional status. [3]
- Contribute to the empirical literature on SFP and health. [4, 5,6,7]

Program Description

- NIP is a nationwide school meal program targeting all compulsory education rural students in impoverished areas, launched in November 2011.
- The program initially covered 699 counties (national pilot counties).
- By 2017, program had been extended to 1,590 counties, benefiting more than 36 million rural students across 134,000 schools.
- Participating students receive school meal subsidies equivalent to 800 yuan (US$130) per year or 7.6% of the average per capita disposable rural income.
  - ✓ Central government provides funds to schools who procure, prepare, and distribute the food among their students (emphasis on lunch provision).
  - ✓ Schools assisted by local government to improve/rebuild their cafeterias.
  - ✓ Program also has a nutrition education component.

Data

- Use data from five survey rounds of CHNS: 2004, 2006, 2009, 2011 and 2015.
  - ✓ 2004-2011 pre-treatment period.
- 32 identified counties covering rural areas followed over time:
  - ✓ 8 counties part of NIP national pilot (treatment area).
  - ✓ 24 counties serve for comparison purposes.
- Working sample: 2,949 enrolled rural students (1,017 in treatment area).

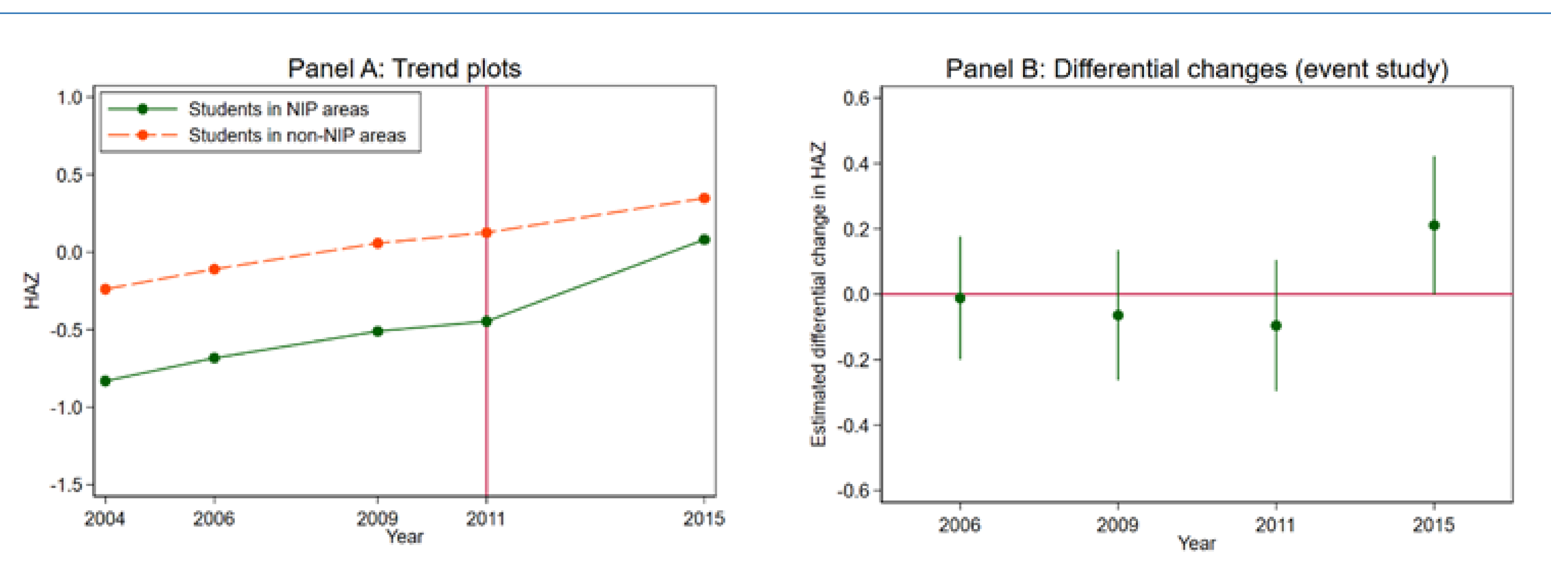

Figure 1. Trend plots and differential changes over time in HAZ between treatment and control cohorts

Note: Panel A reports the sample average HAZ for each cohort in each survey year. Panel B reports the estimated differential changes over time in HAZ. The point estimates are the corresponding coefficients of the interaction terms between the year indicators and treatment dummy variable, and the vertical lines are the 95% confidence intervals. Sample size = 2,949 students.

Methodology

- We follow a quasi-experimental approach exploiting cross-county differences in NIP implementation.
  - ✓ Compare changes in anthropometric measures among compulsory rural students located in NIP areas, before and after program implementation, relative to akin rural students located in areas not covered by NIP.
- We implement two methods:
  1. Differences-in-differences (DID) model to derive an average treatment effect on the treated (ATT).
  2. Changes-in-changes (CIC) model to derive distributional treatment effects on the treated (DTT).
- **Figure 1** provides support for the parallel trend assumption key to implement DID and CIC models.
- To better account for potential unobservable confounders, we also consider alternative control groups by pre-matching treatment and control areas.

Table 1. Average treatment effects on height-for-age z-score (HAZ) based on DID estimations

DID estimator	Dependent variable: HAZ		
	Full sample	Matched counties	Matched villages
Pooled OLS model	0.252**	0.441***	0.397***
	(0.103)	(0.120)	(0.110)
GLS random effects model	0.153*	0.316***	0.318***
	(0.091)	(0.120)	(0.104)
# observations	2,949	1,831	2,016
Control variables	Yes	Yes	Yes
Village Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Note: ***, **, * Significant at 1%, 5%, and 10% level. Robust standard errors reported in parentheses. Counties and villages were paired using Mahalanobis distance matching. Control variables include student characteristics (gender, age, if single child), household characteristics (father and mother years of education, mother's age, household size, per capita household income), and village time-varying economic, health and social services' scores.

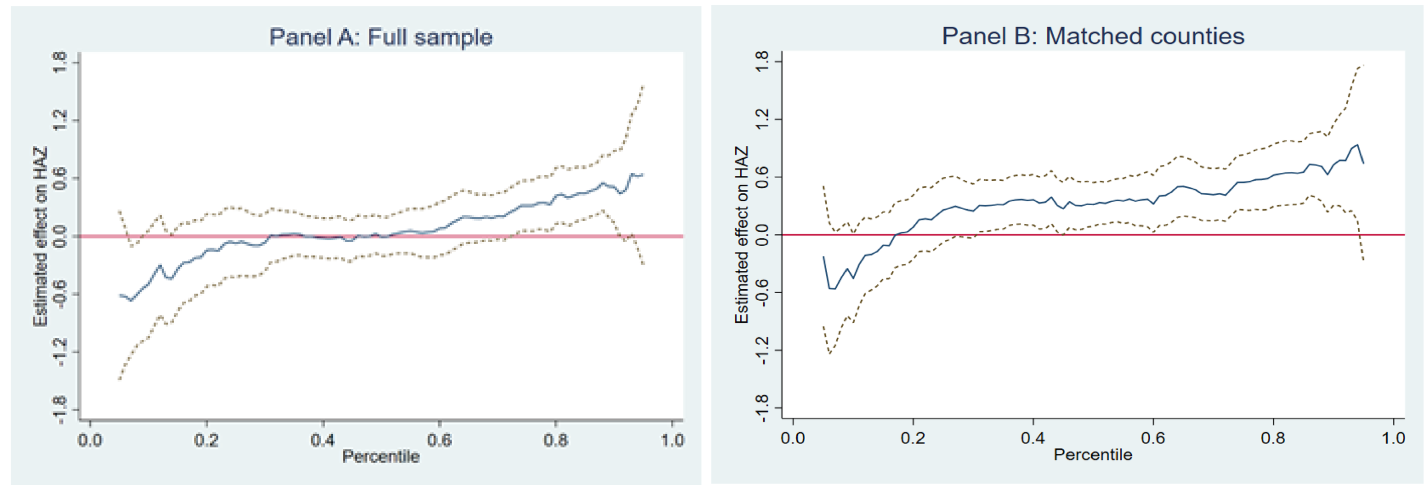

Figure 2. Percentile treatment effects on height-for-age z-score (HAZ) based on CIC estimations

Note: Panel A is based on the full sample (2,949 students), and Panel B is based on the matched sample from pairing treatment and control counties using Mahalanobis distance matching (1,831 students). The dashed lines are 95% confidence intervals obtained from 2,000 bootstrap replications.

Results

- **Table 1** reports the ATT based on DID estimations and reveals that NIP participation is associated with a 0.2-0.4 standard deviations increase in the height-for-age z-score (HAZ).
  - ✓ We consider both pooled and random effects models as 60% of students is only observed in one survey round (and 30% in two survey rounds).
- **Figure 2** depicts the DTT based on the CIC model and shows a larger effect on students with an initial higher HAZ.
- **Other comparison groups**: Similar effects (0.3-0.4 standard deviations) when limiting comparisons to 1) counties within the same province, and 2) counties included in subsequent local NIP pilots after our study period.
- **Heterogeneous effects:** Higher NIP impact on girls; no differences on age, if single child, parents' education, and mother's age.
- **No effects on other anthropometric measures**: 1) likelihood of being stunted; 2) Body Mass Index BMI-for-age; and 3) weight-for-age.
- Multiple **robustness checks** support the estimations:
  - ✓ Placebo tests: no effects on alternative samples and treatment periods.
  - ✓ No effects on school enrollment (selection).
  - ✓ Evidence of random sample attrition.

Conclusions

The results suggest that NIP is partially improving rural students' health, at least on HAZ over the first years of implementation, but more support is needed, through more intensive health and nutrition interventions, to achieve larger impacts. Future work should assess medium-term effects as more data become available.

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