

# Lockdown Effects on Rural-Urban Educational Disparities for Students: Evidence from Four-Wave Surveys in China

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## Abstract

This study estimates the impact and underlying mechanisms of the lockdown policy on the educational disparities between urban and rural students in China. Using a nationally representative dataset of 3,164 primary and secondary school students from 2014 to 2020 and a triple-differences (DDD) model, we find that the lockdown measures exacerbate the pre-existing math performance gap between urban and rural students. Interestingly, the disparity in Chinese language performance narrows. These findings hold robust across various specifications, no matter considering specific days under lockdown, being locked for the entire semester, or conditional on the number of local confirmed cases. The observed mechanisms indicate that differences in students' time utilization explain the narrowing gap in Chinese language performance, while gap in parental human capital contributes to the widening disparity in math. Differences in the supply and the ability of utilizing public education resources, along with the negative impact of parental unemployment pressure, contribute to the decline in rural students' academic performance.

## Baseline Results

1. We observe that, following the occurrence of the COVID-19, no matter considering lockdown days or in the extreme case of being consistently under lockdown, the disparity in math exam results and standardized math cognitive test scores between urban and rural students significantly widens.
2. However, the gap in Chinese language exam results and standardized reading cognitive test scores between urban and rural students significantly narrows.
3. The DID estimation results from urban and rural samples indicate that lockdown measures result in a significant decline in Chinese language performance for both urban and rural students, with the decline being more pronounced among urban students. For math outcomes, the lockdown only leads to a significant decrease among rural students.

## Introduction

After schools, the great equalizer, were forced to close for months in most countries due to the COVID-19, the potential learning losses resulting from the pandemic have attracted significant attention from researchers (Agostinelli *et al.*, 2022; Betthäuser, Bach-Mortensen & Engzell, 2023). However, there is currently limited research on the impact of lockdown measures on the educational disparities between urban and rural students and the potential mechanisms.

A literature closely related to this study estimated the magnitude of learning loss, the heterogeneous impacts of different socioeconomic status, and the persistent effects on children's future income, through a comparison before and after the pandemic (Engzell, Frey & Verhagen, 2021; Fuchs-Schündeln *et al.*, 2022; Singh, Romero & Muralidharan, 2022; Cai, Fu & Luan, 2023; Guariso & Nyqvist, 2023).

In comparison to previous research, this study accurately estimates the effects of lockdown measures and their varying durations for different groups on the educational performance of primary and secondary school students. We primarily focus on the relative disparities between urban and rural areas and attempt to understand the underlying mechanisms. Additionally, we concentrate on China, the epicenter of the COVID-19, contributing to the literature on middle and low-income countries.

Table 1: Lockdown Effect on the Disparities in Rural-Urban Educational Performance

	Dep. Var: The Probability of Achieving Merit or Good in Math Exam						Dep. Var: The Probability of Achieving Merit or Good in Language Exam					
	Ind. Var: Locked For Entire Semester			Ind. Var: Days of Lockdown			Ind. Var: Locked For Entire Semester			Ind. Var: Days of Lockdown		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lockdown × Covid × Urban	0.203** (0.097)	0.220** (0.100)	0.208** (0.103)	0.010** (0.005)	0.011** (0.005)	0.011** (0.005)	-0.343** (0.158)	-0.345** (0.174)	-0.366** (0.184)	-0.009*** (0.003)	-0.008** (0.004)	-0.008** (0.004)
Household Controls			Y			Y			Y			Y
Individual Controls		Y	Y		Y	Y		Y	Y		Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
County × Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weighted Sample	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean (Dep. var)	0.559	0.565	0.566	0.573	0.579	0.579	0.561	0.567	0.568	0.573	0.579	0.579
# Individuals	3,164	3,014	2,982	3,002	2,843	2,819	3,164	3,014	2,982	3,002	2,843	2,819
# Observations	8,397	7,905	7,812	7,499	7,041	6,982	8,397	7,905	7,812	7,499	7,041	6,982
R-squared	0.632	0.639	0.640	0.799	0.806	0.810	0.739	0.753	0.749	0.785	0.794	0.796

Note. The results of both math and Chinese language exams are classified as merit, good, passed, and failed. Individual controls include age, body mass index, sleep duration and a dummy representing whether early love occurs. Household controls include average schooling of parents, number of children, logged book collection, logged government subsidies and an indicator for single-parent family. County-level clustered standard errors are in parentheses. Y indicates that the control is included in the specification. Significance: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

## Data Sources

A nationally representative dataset comprising 3,164 primary and secondary school students from four waves (2014, 2016, 2018 and 2020) of the China Family Panel Studies (CFPS) provides individual characteristics such as grade, academic performance, standardized cognitive test results, as well as parental and household features.

The corresponding regional data includes the number of lockdown days in the counties where the students reside during the spring semester of 2020, as well as the number of monthly confirmed COVID-19 cases in the prefecture-level cities. We collected them from local government websites and the State Council app.

## Identification Strategy

Difference-in-Difference-in-Differences (DDD) estimation:

$$Y_{icjt} = \beta_0 + \beta_1 \text{Lockdown}_{ic} \times \text{Covid}_t \times \text{Urban}_j + \beta_2 \text{Lockdown}_{ic} \times \text{Covid}_t + \beta_3 \text{Lockdown}_{ic} \times \text{Urban}_j + \beta_4 \text{Covid}_t \times \text{Urban}_j + \theta X_{it} + \lambda_i + \gamma_t + \delta_c \times \gamma_t + \varepsilon_{icjt}$$

where the outcome of interest, denoted by  $Y_{icjt}$ , represent the exam results or standardized cognitive test scores for the  $i_{th}$  student residing in the  $c_{th}$  county in the  $t_{th}$  year.  $\text{Lockdown}_{ic}$  indicates the number of days the  $c_{th}$  county was under lockdown or a dummy indicating whether the  $i_{th}$  student was locked for the entire spring semester.  $\text{Covid}_t$  is a dummy indicating whether the pandemic has occurred.  $\text{Urban}_j$  is also a dummy indicating whether the student resides in urban area.  $X_{it}$  represents a set of controls. The equation also includes individual fixed effects  $\lambda_i$ , year fixed effects  $\gamma_t$ , and county-year fixed effects  $\delta_c \times \gamma_t$ .

## Mechanisms

### 1. Individual Time Use

The disparity in how students utilize their time during the lockdown period explains the narrowing of the urban-rural gap in Chinese performance. Specifically, the gap in the probability of daily gaming significantly widens between urban and rural students, while the disparities in the amount of reading and daily study time significantly decrease.

### 2. Parental Response

Math typically requires a higher level of guidance and more involvement in tutoring. We first proved that parental schooling has significantly improved children's math performance instead of Chinese language after lockdown measures. Then, the estimation results indicated that the higher education level of urban parents lead to the higher probability that children receive parental homework guidance and the longer time spent on math-related tutoring.

### 3. Public Educational Resources

The gap in the probability of urban and rural students being provided with online courses significantly widens after the implementation of lockdown measures, and the disparity in internet usage time also increases significantly. This, to some extent, explains why both Chinese language and math results decline among rural students.

### 4. Family Environment

We found that after the implementation of lockdown measures, the number of arguments between parents and the probability of being corporal punished significantly increased for rural students, and there was also a significant decline in standardized mental health. However, all of the changes for urban students were not significant.

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