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The Impact of Double Reduction Policy on College Entrance Examination Performance: Empirical Evidence

Jiayao Zhang[1,a,*]

[1]*School of Economics, Fudan University, Shanghai, 200433, China*
a. 1812010427@stu.hrbust.edu.cn
**corresponding author*

Abstract: In China, the College Entrance Examination weights great in both students' and parents' hearts, which is even recognized as the rare chance to change a people's fate. At this circumstances, heavy homework, countless tests, little break time, burning night oils and even extracurricular tutoring on the weekends have become the daily routine for Chinese high school students, which have hurt their health conditions and added great burden on their mental health. To curb this long-standing issue caused by this phenomenon, a new educational policy called Double Reduction was released by the Chinese government on 2021 and nine Chinese cities are selected as the national policy pilot areas to test the effect in advance. This paper aims to verify the impact of the Double Reduction Policy in some provinces in which lie the selected policy pilot areas. Through continuous difference-indifference method, this study found no significant correlation between the Double Reduction and the College Entrance Examination performance in these areas. Policy makers should make proper actions to implement this new policy, in order to lighten the physical and mental burden of students and the financial burden of parents while take students learning effectiveness into consideration meanwhile.

Keywords: Double reduction policy, Difference-in-Differences (DID) model, Examination.

1. Introduction

The Double Reduction Policy refer to the reduction in students' homework burden and the reduction in the off campus training burden. In China, this policy is implemented first in nine selected cities, which has relevance work experience and good financial conditions [1]. Chinese parents tend to send their children to private supplementary tutoring in the purpose of letting their students enter top schools. With the gradually implementation of this policy, an increasing number of education enterprises are forced into transitions, layoffs, bankruptcies or even shut down their off-campus tutoring service, which results in the daily rising concern of pulling down students examination performance in some parents' hearts.This study aims to research the real-world effect of changes in College Entrance Examinations performance of high school students in selected policy pilot areas in China.

The "double reduction" policy was released by Chinese government in the purpose of improving the quality of school teaching, regulate the training behavior of out-of-school training institutions, and reduce the excessive burden of homework and out-of-school training for students in compulsory education stage, Chinese government has released the "double reduction" policy [2]. And according

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to national laws, off-school training institutions should be taken same regulation methods as compulsory education during the high school phase, including schools and education enterprises are forbidden to offer courses to high school students during vacations [3]. And after the implementation of this policy, as a social group, parents are greatly concerned about whether their children can climb up into upper classes through education, as education is mainly composed of three factors: family, school and society, and out-of-school training contributes a lot to the last one [4], while social training institutions, by hyping and taking full advantage of such anxiety, make profits [5]. A number of scholars have conducted studies and discussions on the impact of the policy on different actors around this, such as the problem in government actions with regulating after-school training like lacking true understanding of the policy spirit and omitting the variance of actual situation in the region [6], the impact on the prospects of teacher professional development [7], and effective measures to alleviate the dilemmas encountered in practice , the "managerial" executive thinking and "conservative" implementation of the education administrative department, the "path dependence" and "captive regulation" of the implementation of primary and secondary schools, insufficient competency for teachers to implement "double reduction", the lack of students' adaptation, insufficient parental participation, and poor social atmosphere, have been discussed [8, 9]. The impact of the policy on high school students' Chinese Gaokao performance is also a perspective worth studying and discussing, but few studies have emphasized the impact of the policy on it. This blow to the shadow education of high school stage would definitely affect the Chinese Gaokao performance of high school examinees in selected pilot areas.

This essay will use the method of continuous difference in difference [10] to analyze the impact of the “double reduction” policy on this aspect, addressing parental worries in response to this policy.

2. Literature Review

From the existing literatures, the overall trend of Double Alleviation Policy in high school stage is putting out-of-school education into regulation. This will undoubtedly affect students’ score performance in selected areas. Due to the difficulty in directly obtaining data of National College Entrance score in the city level, this study cannot directly evaluate the effect of difference between national pilot city and other cities brought by this policy change. This article will mainly evaluate how does high school students ultimate test performance, Chinese Gaokao, affected by the remarkable change in the educational field, Double Reduction, in China on a provincial level.

This study adopts continuous difference-in-difference method [10] to evaluate this effect.

2.1. Experimental Data

Relevant data on first line rate, second line rate and score of college entrance examination in five provinces of China (in which each locates one national Double Reduction pilot area) are collected from Beijing Education Examinations Authority, Shanghai Education Examinations Authority, Shandong Province Academy of Educational Recruitment and Examination, Shanxi Province Educational Recruitment and Examination Web and Higher Education Examinations Authority of Henan Province. Due to the variance of time and areas of the College Entrance Examination Admission Policy, high score priority placement line and special type control line are both recognized as College Entrance Examination First tier line (College Entrance Examination First tier line and the total of the first and second tier line of college entrance examination are abbreviated as first line and second line in the later content respectively), and as the several top score in some provinces haven't announced, the Median interpolation method is adopted to calculate the average score. To better reveal the impact of the Double Reduction Policy on high school students college entrance examination performance, Ordinary high school student's average education expenses for general

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public utilities and proportion of full-time teachers with graduate degrees in regular high schools are selected as covariates representing the quality of education based on the Statistical Indicator System for Education Monitoring and Evaluation in China, and data are collected from National Bureau of Statistics, Ministry of Education and Ministry of Education of the People's Republic of China respectively. What's more, as the statistics of those two education indicators are only announced officially until 2022, this can only investigate a short time, approximately one year interval, after the publication of the Double Reduction Policy in educational field, so the relevant data are selected from 2019 to 2022.

Relevant formulas are as follows:

Index.1: First line rate=the number of students who's score is over the College Entrance Examination first line/ total number of students who attend the College Entrance Examination

Index.2: Second line rate=the number of students who's score is over the College Entrance Examination second line/ total number of students who attend the College Entrance Examination

Index.3: Score (Average score) = ∑ (each score*corresponding number of students)/total number of students who attend the College Entrance Examination

Last but not the least, it's worth mentioning here that though Liaoning Province, Guangdong Province and Jiangsu Province are selected as the Double Reduction Policy pilot areas too, but they are not adopted as research objects as they have been experiencing the New college Entrance Examination Reform during this period.

2.2. Continuous Difference-in-differences Model

This study adopts continuous difference-in-difference method to verify the impact of the implementation of the Double Reduction Policy on ordinary high school students' college entrance examination performance in five selected national pilot areas.

Continuous difference-in-differences method is mainly used for evaluating policy effectiveness of variance strength in different areas in sociology. This principle is evaluating changes in factor y observed in regions with different levels of policy implementation intensity based on the continuity policy intensity in different areas.

For an exogenous policy shocks, the samples are divided into a treatment group with high policy intervention and medium policy intervention and a control group with low policy intervention. As province fixed effect and time fixed effect have been considered in y between the treatment group and the control group, this part can consider the changes in y before and after the occurrence of policy in the control group as a counterfactual result when the treatment group is slightly affected by policy shocks. By comparing the changes in Treatment group y ($D1$) and Control group y ($D2$), then can obtain the actual effect of policy shocks ($DD=D1-D2$).

Beijing city, Shanghai city, Weihai city in Zhejiang Province, Chengzhi City in Shanxi Province and Zhengzhou city in Henan Province are selected among the nine Double Reduction national pilot areas, however, provincial level rather than the city level analysis is adopted as the statistics of city level college entrance examination has not been published. The ratio of national Double Reduction pilot areas and the total number of prefecture level cities are calculated as the policy intensity indicators, with the higher the ratio the stronger the policy impact is, vice versa. Based on this method, these five provinces are divided in three groups: Beijing and Shanghai as high policy intensity group, Shandong province as medium policy intensity group and Shanxi province and Henan province as low policy intensity group. Therefore, the traditional difference-in-difference model is not applicable in this study. Based on this, this study adopts a continuous difference-in-difference model suitable for continuous policy intensity samples. The formula of the model is expressed as follows:

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$$Index_{pt} = \alpha_o + \alpha_1 Post_t + \alpha_2 Treat_p + \alpha_3 Post_t \times Treat_p + \alpha_4 fee + \alpha_5 teacher + \varepsilon \quad (1)$$

$$Index = \text{first line rate, second line rate and the average score} \quad (2)$$

$Post_t \times Treat_p$ is an interaction term representing whether the exogenous impact have had effect on a sample. It equals 1 for chosen treatment group, high policy intensity areas or medium policy intensity area respectively, once the policy has been implemented and 0 for treatment group before being treated and control group. In this case, $Post_t \times Treat_p$= 1 since July 2021 for all three groups, $Post_t \times Treat_p$ = 0 for other cases. $Treat_p$is an indicator variable representing whether the sample is in treatment group or control group. In this case, it equals 1 for samples in high policy intensity areas referring to Beijing and Shanghai medium and medium policy intensity area referring to Shandong and 0 for all low policy intensity areas referring to Shanxi and Henan. $Post_t$is a dummy variable whose value that represents the time effect.

3. Data Analysis and Results

3.1. First line rate, second line rate and score Regression

The first line rate, second line rate and score of college entrance examination regression results are shown in Table 1.

Table 1: First line rate, second line rate and score regression

	first line rate		second line rate		Score	
	(1)	(2)	(3)	(4)	(5)	(6)
fee	-0.00000 (0.00000)	-0.00001* (0.00000)	-0.00001* (0.00000)	0.00001 (0.00002)	-0.001 (0.001)	-0.013 (0.011)
teacher	-0.193 (0.133)	0.351** (0.095)	-0.117 (0.143)	0.115 (0.640)	-59.083 (42.825)	9.503 (355.748)
post2022:treatment_h	-0.039 (0.040)		-0.063 (0.043)		1.910 (12.987)	
post2022:treatment_m		0.052** (0.016)		0.019 (0.105)		26.237 (58.595)
Constant	0.650** (0.220)	0.114 (0.062)	1.278*** (0.236)	0.227 (0.420)	*570.790* (70.949)	*659.572* (233.471)
Observations	16	12	16	12	16	12
Controls	Yes	Yes	Yes	Yes	Yes	Yes

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Table 1: (continued).

R2	0.994	0.995	0.997	0.940	0.992	0.973
Adjusted R2	0.986	0.980	0.991	0.782	0.980	0.903
Residual Std. Error	0.018 (df = 6)	0.003 (df = 3)	0.019 (df =6)	0.024 (df = 3)	5.711 (df = 6)	13.068 (df = 3)
F Statistic	119.359*** (df = 9; 6)	69.432*** df = 8; 3)	194.411*** (df = 9; 6)	5.926* (df = 8; 3)	80.791 (df = 9; 6)	13.737 (df = 8; 3)

Note: *p<0.1; **p<0.05; ***p<0.01

(1) and (2) are regression results of the first line rate in high policy intensity areas and medium policy intensity area respectively; (3) and (4) are regression results of the second line rate in high policy intensity areas and medium policy intensity area respectively; (4) and (5) are regression results of the average score in high policy intensity areas and medium policy intensity area respectively.

From the table, it's immediately clear that the R2 and Adjusted R2 are approximately 1 and SE are really indistinctive in the regression results of first line rate and the second line rate, which indicate the significant linear relationship between the index and the covariates and the high precision in these two models. The R2 and Adjusted R2 are approximately 1 in the regression results of average score either, which implies the significant linear relationship between the index and the covariates, however, SE of it is obvious, so the model may not be precise. When considering the p-value of F Statistic, it's significant in the first line rate regression in both high and medium policy intensity areas and second line rate high policy intensity areas, revealing the model significance. As post*treatment is considered, it's only obvious in the regression result of first line rate in medium policy intensity area . Thus it can be concluded that the Double Reduction Policy has positive impact on second line rate of high school students' college entrance examination in medium policy intensity area, Shandong province, but exerts slight negative impact on first line rate and second line rate in high policy intensity areas.

3.2. Parallel trend Test

A parallel trend test was conducted to test the robustness of the empirical results. The test was done simply by resetting the ***post*** dummy variable. Its value equals 1 only if current year is the last year before the policy shock, year 2021.

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Table 2: Parallel trend Test

	first line rate		second line rate		Score	
	(1)	(2)	(1)	(2)	(1)	(2)
fee	-0.00000 (0.00000)	-0.00001 (0.00002)	-0.00000 (0.00000)	-0.00001 (0.00002)	-0.001 (0.001)	-0.011 (0.011)
teacher	0.099 (0.171)	-0.009 (0.324)	0.099 (0.171)	-0.009 (0.324)	-89.512* (42.931)	-110.029 (183.461)
post2021:treatment_h	0.012 (0.045)		0.012 (0.045)		-7.608 (11.217)	
post2021:treatment_m		-0.006 (0.048)		-0.006 (0.048)		6.778 (27.265)
Constant	1.000** (0.276)	0.246 (0.397)	1.000** (0.276)	0.246 (0.397)	609.285 (69.263)	*708.279* (225.069)
Observations	16	12	16	12	16	12
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.995	0.940	0.995	0.940	0.992	0.972
Adjusted R2	0.989	0.781	0.989	0.781	0.981	0.898
Residual Std. Error	0.022 (df = 6)	0.024 (df = 3)	0.022 (df = 6)	0.024 (df = 3)	5.514 (df = 6)	13.361 (df = 3)
F Statistic	145.782*** (df = 9; 6)	5.892* (df = 8; 3)	145.782*** (df = 9; 6)	5.892* (df = 8; 3)	86.722 (df = 9; 6)	13.126 (df = 8; 3)

Note: *p<0.1; **p<0.05; ***p<0.01

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It can be seen from table 2 that the ***post*treatment*** dummy variable is both close to zero and insignificant in the regression results of first line rate and second line rate, so the parallel results prove that the first line rate and second line rate regression results are robust.

4. Conclusion

Based on the empirical results, it can be concluded that the Double Reduction Policy has positive impact on second line rate of high school students' college entrance examination in medium policy intensity area, Shandong province, but exerts slight negative impact on first line rate and second line rate in high policy intensity areas.

Due to various reasons such as data availability, this study cannot directly evaluate the impact of the implementation of the Double Reduction Policy on city level, and can only conduct the evaluation only one year after the publication of this act. It may take time and effort for schools, parents and more important, the high school students to adapt to this transformation. In addition, the insufficient research objects, only five provinces, and the variance educational and financial circumstances in different areas in China, this study outcome in these five provinces just a year after the transformation doesn't mean it will have the same policy results in other areas of the country in the following year.

However, these do not mean that the study is meaningless. This study can at least prove that the Double Reduction Policy do has impact on high school students' college entrance examination performance. For high policy intensity areas, it slightly pulled down both the first line rate and the second line rate, however, for medium policy intensity area, it improves the first line rate notably. This study indicates that the implementation of the Double Reduction Policy ha sthe possibility to reduce high school students stress and maintain or even improve their learning performance at the same time, as this policy are implemented well for schools, faculty and students.

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