The Impact of the Double Reduction Policy on China's K-12 Education Industry: An Empirical Analysis Based on the Difference-in-Differences Method

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Abstract. The Double Reduction Policy introduced by the Chinese government in 2021 imposed unprecedented restrictive measures on privately-run extracurricular training institutions providing compulsory education subjects. Numerous education enterprises involved in K-12 business were profoundly affected. To explore the impact of the policy on education enterprises and the industry, this paper employs the Difference-in-Differences method for analysis. The findings reveal that the "Dual Reduction" policy led to an 8.165% decline in the profit margin of education enterprises, accompanied by a significant reduction in the number of employees, with an assessed decrease of 31.57%. Further analysis of the impact mechanism indicates that the policy's effect on the number of employees lags behind its impact on profit margin. Based on these results, the study suggests the optimization of the content and implementation approach of education policies to minimize negative impacts and to incorporate high-quality education resources provided by education enterprises through more comprehensive measures.

Keywords: Education industry; policy impact analysis; difference-in-differences method.

1. Introduction

On July 26, 2021, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council of the People's Republic of China issued the "Opinions on Further Reducing the Academic Burden and Extracurricular Training Burden of Students in Compulsory Education Stage" (hereinafter referred to as the "Double Reduction Policy") [1]. This policy document aims to alleviate the academic burden of students in China's compulsory education stage (six years of primary school and three years of junior high school). In addition to a series of optimization regulations for homework arrangements and after-school services in public schools, the most notable measures are those restricting extracurricular training institutions. The Double Reduction Policy stipulates unprecedented rigorous censorship and supervision by the government for subject-based extracurricular training institutions targeting compulsory education stage students. All such institutions are required to register as non-profit entities, and they are prohibited from engaging in capitalization operations such as public financing. Various restrictions and regulations are also imposed on the scope, content, and form of training services. As a result of the policy, subject-based training in the compulsory education stage can no longer serve as a profit-making business for educational enterprises. Before this, such training known as K-12 education services in the industry, occupying a significant proportion of many education businesses. The Double Reduction Policy undoubtedly had a profound impact on the operational status of educational enterprises involved in this business. With the inability to continue old business practices, companies inevitably had to lay off employees to reduce operating costs and maintain profits, putting a substantial number of employees at risk of unemployment.

As of now, the Double Reduction Policy has been implemented for over two years, and its various provisions have gradually been put into effect, influencing the educational landscape. There is widespread concern about the extent to which the policy has affected the business operations of educational enterprises involved in K-12 education services? Has it significantly reduced the number of positions in the education industry, leading to a situation where many professionals in the field need to find alternative means of earning a living? This study aims to assess the impact of the Double

Reduction Policy on the profitability and employment levels of educational enterprises involved in K-12 education (12 years of education from primary to secondary school) through empirical analysis. The goal is to objectively present the economic impact of the policy and provide theoretical support for further optimizing educational industry policies, offering insights into regulating and guiding the healthy development of the Chinese education industry.

2. Literature Review

2.1. Impact of the Double Reduction Policy

2.1.1 Social impact

In the academic realm, the focus on the impact of the Double Reduction Policy primarily revolves around its educational significance, and due to it is not highly relevant to this study, it will not be elaborated here. In terms of its social impact, scholars are primarily concerned with the target groups affected by the Double Reduction Policy [2], the policy's influence on family education investment strategies [3], the impact of public schools providing after-school services on the demand for subject-based extracurricular training [4], and the process of policy implementation [5]. These social impacts constitute the social context of the Double Reduction Policy's influence on educational enterprises and the education industry.

2.1.2 Economic impact

In analyzing the economic impact of the Double Reduction Policy from the perspective of economics, scholars have pursued two main research directions. The first involves analyzing the transformation paths of educational enterprises under the policy context, with a predominant focus on case studies of individual companies, such as the case analysis of the transformation of the leading education enterprise New Oriental [6]. The second direction involves a comprehensive study of the entire industry structure, encompassing both quantitative and qualitative research. Scholars have indeed found that the Double Reduction Policy has a tangible impact on educational enterprises. Zhang and others contend that the Double Reduction Policy simultaneously affects the input and output of educational enterprises, inevitably leading to changes in economic benefits [7]. Liu used event study methodology to analyze the stock price changes of publicly listed education enterprises involved in K-12 business after the policy announcement, discovering a significant drop in stock prices due to the Double Reduction Policy [8].

However, there has been limited research on the extent of the impact of the Double Reduction Policy on enterprises and industries. A scholar has analyzed the impact of the Double Reduction Policy on corporate performance using the Difference-in-Differences method [9], but the sample used was limited to companies listed on the A-share market in China, and there was no attention given to its impact on the crucial corporate indicator of the number of employees. In fact, representative large enterprises involved in K-12 business, such as New Oriental and TAL Education, are listed on the U.S. stock market and the Hong Kong stock market. Building upon this foundation, this study seeks to broaden the sample size of empirical analysis, covering companies from both domestic and international stock markets to obtain more representative analytical conclusions. Simultaneously, considering the changes in the number of employees will have profound implications for the entire industry and even the entire labor market, this study aims to innovate in the analysis of this indicator.

2.2. Methods and Cases Studying the Impact of Policies on Enterprises

Empirical analysis of policy impacts is a hot topic in academia. Numerous policy studies have analyzed the effects of policies such as green credit, tax policies, and export controls on relevant enterprises. A scholar, through constructing a Difference-in-Differences model, found that the impact of green credit policy on green innovation for heavily polluting enterprises is negative [10]. Others built multi-period Difference-in-Differences models and discovered that U.S. export control policies inhibited investments received by Chinese enterprises [11]. This study draws on these methods of

policy impact research and applies them to the field of the Double Reduction Policy and the education industry.

3. Research Design

3.1. Research Hypotheses

The Double Reduction Policy directly restricts educational enterprises from conducting subject-based training business at the compulsory education stage through administrative orders. The decrease in business volume will lead to a decline in enterprise revenue, consequently resulting in a decrease in enterprise profits. Therefore, for educational enterprises involved in K-12 education business, the hypothesis is as follow:

Hypothesis 1: The Double Reduction Policy leads to a significant decrease in the profit margin (return on assets) of educational enterprises involved in K-12 education business.

Simultaneously, the decrease in business volume will lead to employee redundancy. To restore profit margins, enterprises may cut staff to reduce labor costs. Hence, there is:

Hypothesis 2: The Double Reduction Policy leads to a significant reduction in the number of employees in educational enterprises involved in K-12 education business.

3.2. Variables and Models

This study utilizes the BVD-Osiris Global Listed Companies Analytics database. Sample data were selected from Chinese listed companies in the education industry from 2018 to 2022, including companies listed on domestic and international stock markets. Samples with severe data deficiencies were excluded, resulting in a sample size of 106 companies. As involvement in K-12 education business is not directly reflected in financial data, manual retrieval and matching were performed to identify 28 companies involved in K-12 education as the treatment group. The remaining 78 companies, not involved in K-12 education, were designated as the control group.

Return on assets (ROA) and the number of employees (Emp) were chosen as the dependent variables. The policy impact point was set as the release time of the Double Reduction Policy in 2021. A Post dummy variable was created, with Post=1 representing the years after 2021 and Post=0 representing the years before 2020, including 2020. A Treat dummy variable was established, with Treat=1 indicating the experimental group of educational enterprises involved in K-12 business and Treat=0 indicating the control group of educational enterprises not involved in K-12 business. The interaction term DID (Difference-in-Differencess) was formed as the explanatory variable. Additionally, based on the characteristics of enterprise data and previous research conventions, control variables such as enterprise size (Size), years since establishment (Age), corporate independence (Indep), the percentage of ownership by the largest shareholder (Top1), and corporate debt ratio (Debt) were included. Data processing was performed using Stata software for the sample companies. Due to the large variability in enterprise size and the number of employees, a logarithmic transformation was applied, and a 1% winsorization was conducted for continuous variables. Variable descriptions and descriptive statistics are shown in Table 1.

Table 1. Variable Descriptions and Descriptive Statistics

Variable	Definition	Mean	Std. Err.
ROA	After-tax Net Profit/Total Assets	-3.4983	26.7868
Emp	ln(Number of Employees)	6.2414	1.9363
Post	Time Dummy Variable	0.4000	0.4904
Treat	Treatment Dummy Variable	0.2642	0.4413
DID	Time Dummy Variable × Treatment Dummy Variable	0.1057	0.3077
Size	ln(Total Assets)	10.8976	2.2936
Age	Years Since Establishment of the Company	14.4434	8.1260
Indep	Conversion of BVD Corporate Independence Indicator to Ordinal	3.5714	3.5026
Top1	Percentage of Ownership by the Largest Shareholder	47.8985	22.4801
Debt	Current Liabilities/Total Assets	0.5252	0.8909

This study employs a Difference-in-Differences analysis to examine the impact effects of the Double Reduction Policy on the profit margin and the number of employees, utilizing the standard DID model for analysis. For hypothesis 1, a basic regression model is constructed

$$ROA_{i,t} = \alpha_0 + \alpha_1 DID_{i,t} + \alpha_2 Treat_i + \alpha_3 Post_t + \alpha_4 X_{i,t} + \varepsilon_{i,t} \quad (1)$$

Here, t represents the year, i represents the company, α_0 is the constant term, $\varepsilon_{i,t}$ is the random disturbance term, $X_{i,t}$ is the set of control variables, and α_1 is the Difference-in-Differences estimate. If α_1 is significantly negative, hypothesis 1 can be validated.
Similarly, for hypothesis 2, a basic regression model is constructed:

$$Emp_{i,t} = \beta_0 + \beta_1 DID_{i,t} + \beta_2 Treat_i + \beta_3 Post_t + \beta_4 X_{i,t} + \varepsilon_{i,t} \quad (2)$$

Here, t represents the year, i represents the company, β_0 is the constant term, $\varepsilon_{i,t}$ is the random disturbance term, $X_{i,t}$ is the set of control variables, and β_1 is the Difference-in-Differences estimate. If β_1 is significantly negative, hypothesis 2 can be validated.

4. Results and Discussion

4.1. Baseline Regression

The results of the baseline regression are presented in Table 2. In Table 2, the first column formula (1) represents the regression results of Model (1) with the profit margin as the dependent variable and no control variables included. The second column formula (2) shows the regression results of Model (1) with the profit margin as the dependent variable and control variables included. The third column formula (3) displays the regression results of Model (2) with the log of the number of employees as the dependent variable and no control variables included. The fourth column formula (4) exhibits the regression results of Model (2) with the log of the number of employees as the dependent variable and control variables included.

Without the inclusion of control variables, the coefficient of the interaction term in Model (1) is negative, but the impact effect is not significant. In Model (2), the interaction coefficient is significantly negative at the 0.01% level, confirming hypothesis 2, indicating that the Double Reduction Policy leads to a reduction in the number of employees in educational enterprises involved in K-12 business. After incorporating control variables, the interaction coefficient in Model (1) is negative and significant at the 5% significance level, confirming hypothesis 1. According to the regression results of this model, the Double Reduction Policy leads to an 8.165% decrease in the profit margin of educational enterprises involved in K-12 business. After introducing control variables, the regression results have become significant. This indicates that, after accounting for variables such as company size and debt ratio, the observed variations in profit margin can be more attributed to the policy. In other words, controlling for factors like company size and debt ratio reveals that the changes in profit margin are more likely to be explained by the implemented policy. In Model (2), the interaction coefficient is significantly negative at the 0.01% level, further confirming

hypothesis 2. In this model, the Double Reduction Policy results in a decrease of 0.864 in the logarithm of the number of employees in educational enterprises involved in K-12 business.

Table 2. Baseline Regression Results

Variable	ROA		Emp	
	（1）	（2）	（3）	（4）
DID	-11.741	-8.165*	1.794**	-0.864***
	(-1.46)	(-2.09)	(2.93)	(-5.41)
Post	-1.596	-0.082	-0.134	-0.003
	(-0.50)	(-0.03)	(-1.65)	(-0.06)
Treat	-1.624	-2.778	-0.488	1.231***
	(-0.45)	(-0.97)	(-0.83)	(5.02)
Size		1.794**		0.673***
		(2.93)		(19.19)
Age		-0.134		-0.006
		(-1.65)		(-0.44)
Indep		-0.488		0.007
		(-0.83)		(0.18)
Top1		-0.123		0.003
		(-1.26)		(0.54)
Debt		1.794**		0.045
		(2.93)		(0.33)
cons	-1.164	-0.134	5.726***	-1.410*
	(-0.57)	(-1.65)	(31.16)	(-2.51)
Observations	512	497	505	490
R^2	0.0276	0.3739	0.2175	0.7802

Note: ***, **, and * represent significance at the 0.1%, 1%, and 5% levels, respectively.

4.2. Parallel Trends Test

The parallel trends assumption must be satisfied for the Difference-in-Differences analysis. The results of the parallel trends tests for the models with the dependent variables being the profit margin and the logarithm of the number of employees are shown in Fig. 1 and Fig. 2. The year of policy implementation (Current) is considered as the treatment year, excluding the year immediately before policy implementation as the baseline group. It can be observed that the 95% confidence intervals of the regression coefficients for both dependent variables in the years 2018 and 2019, before policy implementation, cross the horizontal line where the coefficient equals 0. This indicates that the interaction term coefficients are not significant at this time, supporting the parallel trends assumption, and the results of the Difference-in-Differences analysis are reliable.

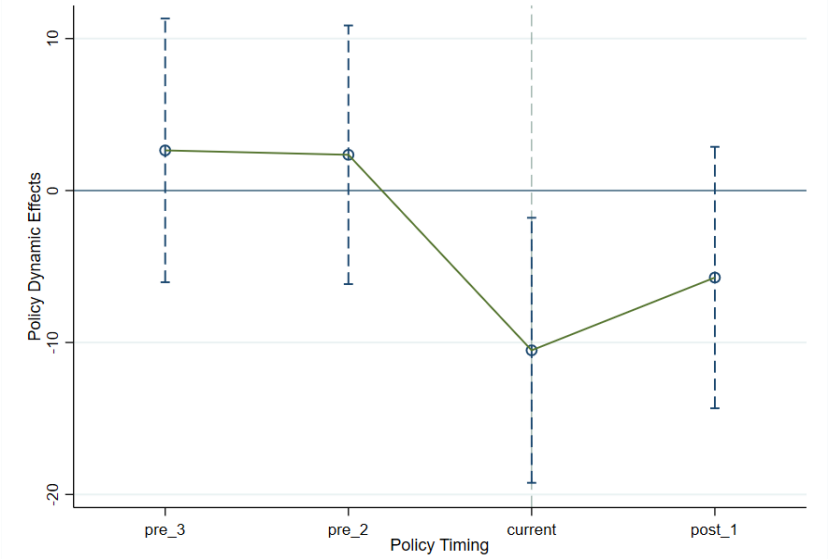

Fig. 1 Parallel Trends Test for the Dependent Variable: Profit Margin

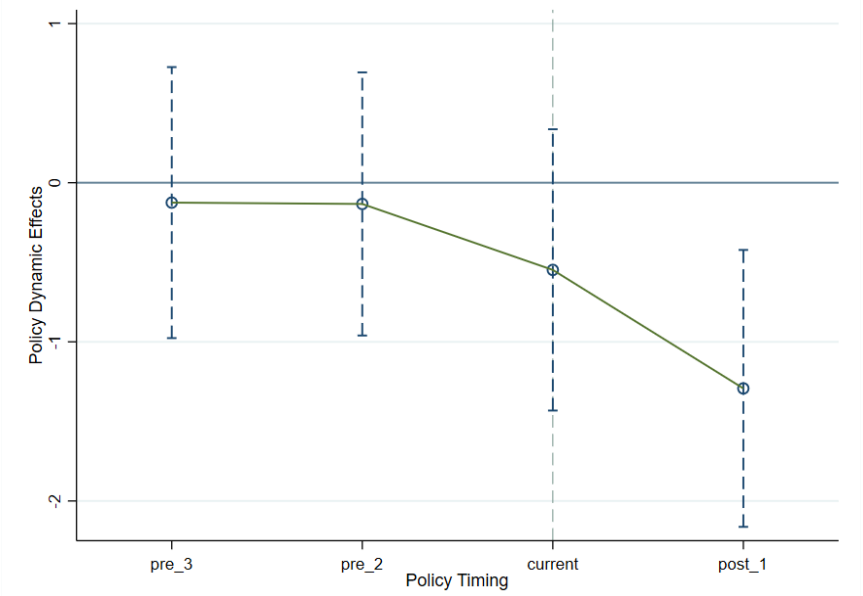

Fig. 2 Parallel Trends Test for the Dependent Variable: Logarithm of the Number of Employees

Additionally, according to the parallel trends graph, we can observe that the negative impact of the Double Reduction Policy on the profit margin of education companies involved in K-12 business has decreased in 2022 compared to 2021. Meanwhile, the impact on the logarithm of the number of employees shows an increasing trend. Further analysis will be conducted in the conclusions and discussions.

4.3. Robustness Checks

To test the robustness of the models, a placebo test is conducted by artificially creating a placebo group for models (1) and (2). Simulations are performed by constructing 500 placebo groups for each model, and the resulting estimated coefficients' kernel density plots are shown in Fig. 3 and Fig. 4. The distribution of the estimated coefficients is centered around zero and follows a normal distribution, consistent with the expectations of the placebo test. This indicates that the policy's impact is not caused by other random factors, confirming the robustness of the baseline regression results.

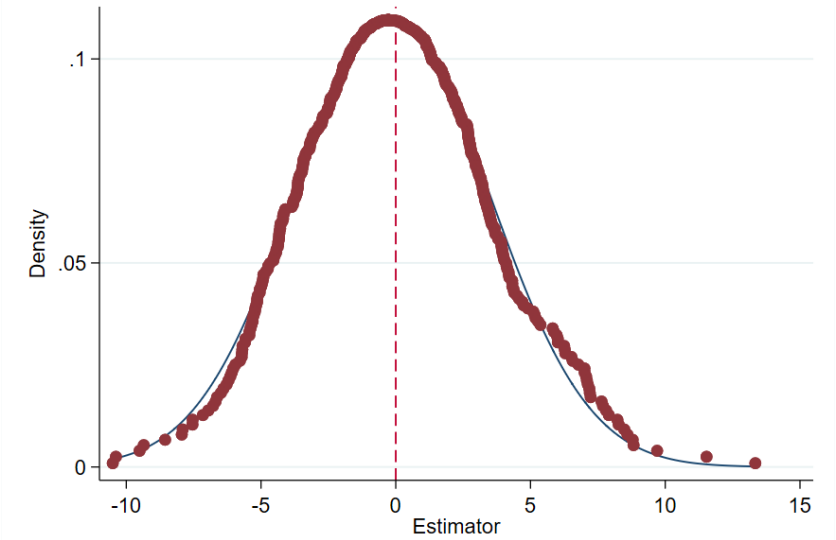

Fig. 3 Parallel Trends Test for the Dependent Variable: Profit Margin

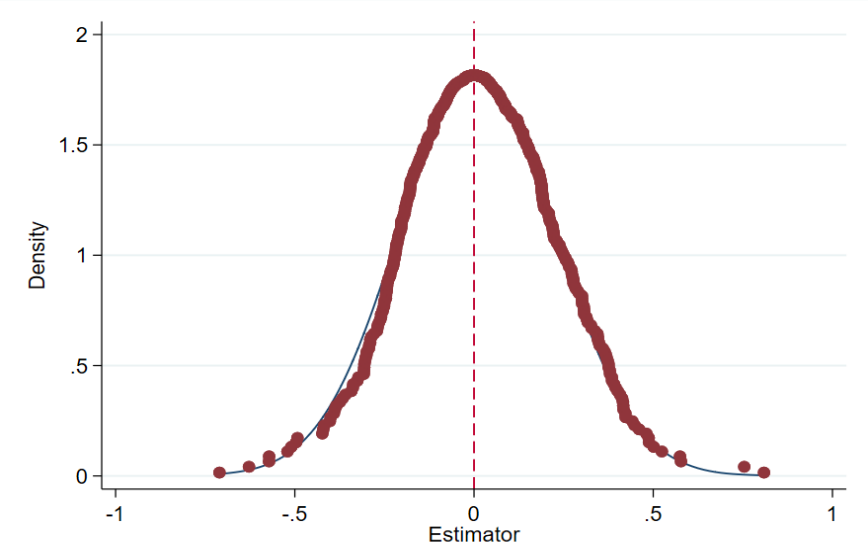

Fig. 4 Kernel Density Plot of Placebo Test for Estimated Coefficients of Logarithm of the Number of Employees

5. Conclusion

The Double Reduction Policy has a significant impact on the profitability of education enterprises, with a more profound and far-reaching effect on the number of positions within these enterprises.

Regarding the mechanism of policy impact on the industry, insights can be gleaned from the parallel trends test figures. In Fig. 1, the profit margin experiences a significant decline in 2021, followed by a partial recovery in 2022. In Fig. 2, the number of employees first decreases in 2021 and then experiences a more substantial reduction in 2022. This may be attributed to a gradual transmission process of the policy's impact on businesses. Under regulation, a reduction in business volume directly leads to a decrease in revenue, while costs cannot be rapidly controlled in the short term—layoffs require a process. Therefore, the policy's impact is initially reflected in the profit margin. After the decline in profit margin, businesses, in order to maintain profits, inevitably undergo layoffs. As the layoff plans are gradually implemented, the number of layoffs increases, and the reduction in the number of employees also becomes more significant. After layoffs, the operating costs of businesses gradually decrease, and the profit margin begins to recover. However, due to limitations in operational scale, it is challenging to reach the previous profit levels.

Regarding the magnitude of the policy's impact on the industry, as mentioned earlier, the policy leads to an 8.165% decrease in profit margin for enterprises, but its impact on the number of employees is more concerning. Using regression analysis with control variables, the policy results in a significant reduction of 3,840 employees per individual enterprise. This outcome is statistically significant at the 5% level. Among the 28 enterprises in the treatment group, the average number of employees per enterprise was 12,165 in 2020, the year preceding the policy implementation. This means that the Double Reduction Policy has led to a 31.57% reduction in the number of employees in education enterprises involved in K-12 education. Among listed education enterprises alone, the policy has caused a reduction of over 100,000 positions.

The first impact of layoffs in the education industry is on regular positions. A large number of employees in the education industry were originally teachers in public schools, attracted by the high salaries of enterprises or possibly dismissed from schools due to mistakes. After leaving education enterprises, returning to public schools becomes their pursuit. Absorbing these teachers back into positions is beneficial for supplementing the educational resources of public schools but may also affect the treatment of other teachers within the system. Simultaneously, since many of these employees excel in exams and problem-solving, a significant portion joins the ranks of those taking civil service exams or seeking regular positions, intensifying competition in these fields. Layoffs also

have an impact on other industries. Due to similarities in skill and qualification requirements, employees laid off by education enterprises may apply for positions in human resources, consulting, and related fields, intensifying competition in these industry segments.

Due to the chaos in the education and training industry, which has already affected the tangible interests of students and parents, the implementation of the Double Reduction Policy is deemed necessary. However, from its impact perspective, there is room for optimization in both content and approach to minimize the negative consequences while precisely achieving policy objectives. The root cause of the chaos in the education and training market lies in the demand for high-quality educational products far exceeding the supply, and this issue cannot be thoroughly resolved in the short term. Research indicates that the Double Reduction Policy can only alleviate some of the demand for education and training services, and the remaining demand is expected to persist in the long term. The expansion of the education and training industry has objectively attracted investments in educational resources, increasing the supply of educational services. If the crackdown is too severe and lacks corresponding supporting measures, it may result in a waste of educational resources, rendering futile the earlier investments in educational resources. From another perspective, due to the persistent demand, these industries may likely go underground, making regulation even more challenging and causing greater losses to students and parents. How to absorb this increased supply to genuinely benefit students and parents with educational resources, while effectively controlling the underground nature of the education and training industry, is a critical issue that education policies need to address. Facilitating some form of collaboration between schools and the education industry, gradually incorporating high-quality extracurricular educational resources, and progressively refining the regulatory system for the education industry may be a feasible strategy to ensure the supply of educational resources and meet the public's demand for high-quality educational resources.

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