Research on the Economic Effects of Compulsory Education in China

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Abstract: This paper aims to investigate the factors driving the rapid development of the Chinese economy. Utilizing univariate linear regression, we examine the impact of compulsory education in China on its economic growth, utilizing data from the National Bureau of Statistics of China spanning the years 1983 to 2006. Additionally, we conduct robustness tests and heterogeneity analyses using variables such as the number of middle school students, Chinese GDP, and the time span from 1983 to 2022. Our analysis also delves into industry-specific variations and expenditure-based approaches. Our findings are summarized as follows: 1. Compulsory education in China exhibits a positive influence on its economic growth. 2. According to the robustness test, the baseline conclusion of this paper is robust. 3. Compulsory education plays a pivotal role in the tertiary industry and net exports but exerts fewer effects on the second industry and investment and contributes a little to the first industry and consumption.

Keywords: economic growth, linear regression, robustness test, heterogeneity analysis

1.   Introduction

Chinese compulsory education is a system wherein all Chinese children and adolescents within the appropriate age range are required to receive education, with the majority of costs borne by the government. The concept of compulsory education dates back to 1619 when a religious leader named Martin Luther King, Jr. proposed its implementation in Germany, aiming to ensure widespread access to "The Holy Bible." In light of the low levels of knowledge prevalent during the early days of the People's Republic of China, the government took significant steps to address illiteracy. In 1985, the Chinese government introduced "The Decision on the Reform of the Education System," followed by the enactment of the "Compulsory Education Law of the People's Republic of China" and the "Outline of China's Educational Reform and Development" in 1986. These initiatives marked the inception of compulsory education in China. Comparatively, in the UK, compulsory education spans 12 years, divided into four stages, with students dedicating five hours per day to their studies. In China, compulsory education covers a period of 9 years, encompassing primary and middle school stages, where students engage in 6 hours of study during primary school and 8 hours during middle school.

China's journey in economic growth is remarkable, with its GDP expanding from approximately 59.716 billion dollars (equivalent to 4% of the global GDP) in 1960 to an astounding 17.73 trillion dollars (equivalent to 18% of the global GDP) in 2021, making it the second-largest economy in the

world. China's status as the fastest-growing and most influential nation among developing countries prompts the exploration of the various factors driving this exceptional development. Notably, China's GDP began a sustained upward trajectory in 1996, a decade after the initiation of compulsory education, contributing to an annual increase of around 1% in its share of the global GDP. While some countries, like North Korea, shared similar starting conditions with China, they have not experienced the same degree of economic progress, underscoring the potential significance of compulsory education in China's rapid economic advancement.

Therefore, this paper seeks to comprehensively analyze the impact of Chinese compulsory education on the country's economic growth. Leveraging insights into the evolution of Chinese compulsory education and utilizing macroeconomic data spanning from 1978 to 2022, this study employs regression models to draw fundamental conclusions. Furthermore, the robustness test and heterogeneity analysis, considering industry-specific and expenditure-based approaches, aim to refine and generalize the findings.

2.   Literature Review

The literature pertinent to this study centers on the exploration of compulsory education. Research by Pengjun and Zhaoxiliang [1] reveals that compulsory education significantly enhances intergenerational mobility among women in western rural areas. Fangchao [2] demonstrates that compulsory education reform notably elevates wage levels for the migrant population. Chenqifei and Wangshuangxu's investigation [3] underscores the practical importance of widespread compulsory education in accelerating economic progress in western regions and fostering societal harmony. The study by Libo et al. [4] highlights substantial improvements in the financial equity of compulsory education spurred by a series of reforms. Songxuguang and Hezongyue [5] assert that augmenting fiscal expenditure in education during the compulsory education phase can mitigate income inequality.

Another strand of literature germane to this study pertains to diverse educational forms. Huanghaigang et al.'s work [6] posits that higher education significantly contributes to high-quality economic development. Pangbo et al. [7] emphasize the integral role of integrated higher vocational education within the Yangtze River Delta's development strategy. Zhaoqingnian and Liuke [8] posit a threshold effect related to scale factors in the correlation between the hierarchy and quality of higher education and economic growth. Wangyafen et al.'s research [9] identifies a substantial reduction in the likelihood of rural residents experiencing poverty through increased years of education. Zhanghongshuai et al.'s study [10] underscores the positive influence of both educational and health-related human capital on high-quality economic development.

Drawing on the insights gained from the aforementioned literature, this study intends to make the following two contributions. Firstly, within the domain of focus, there is a dearth of articles examining the impact of Chinese compulsory education on the nation's economy. This paper addresses this gap by employing the number of middle school graduates as a proxy for Chinese compulsory education, analyzing its influence on the Chinese economy. Secondly, with regard to research methodology, this study employs robustness testing and two distinct types of heterogeneity analysis, specifically industry-based and expenditure-based approaches.

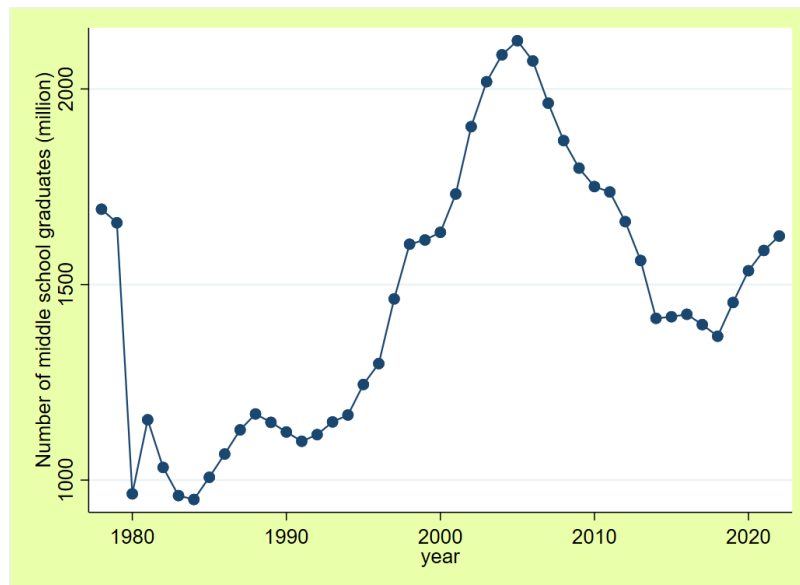## 3. Characteristics of Compulsory Education in China

Figure 1: Trend in number of Chinese middle school graduates.

Stage 1 (1978–1984): The rate of middle school student graduation witnessed a decline during this period. This phenomenon can be attributed to the historical context of that era. In 1983, the Chinese government dissolved the people's commune—a communal organization that shared resources, including schools—leading to a significant reduction in the number of schools. This reduction was primarily due to the financial challenges faced by individuals, resulting in a drastic decrease in available schools and consequently, a decline in the number of middle school graduates.

Stage 2 (1985–2005): The rate of middle school student graduation experienced a gradual increase during this phase. This can be attributed to the official implementation of Chinese compulsory education in 1985. Prior to this period, a substantial portion of children did not attend school. Limited access to schools and the need for additional labor in households and farms led families to prioritize chores and work over schooling. To address this issue, the Chinese government invested in building schools, took on significant financial responsibility, and mandated the enrollment of young children in schools. Consequently, the number of students attending schools increased compared to the conditions in 1983, leading to an upsurge in the middle school graduation rate.

Stage 3 (2006–Present): The rate of middle school student graduation has experienced a notable decline in recent years. The cohort of students graduating in 2006 was born around 1991, a period during which the Chinese government implemented the "one-child policy." Violating this policy resulted in severe penalties, including job loss and substantial fines. Consequently, the number of children born in 1991 declined significantly, leading to a scarcity of students graduating in 2006. Despite a recent increase in the number of junior secondary school graduates over the past two years, the level of development has not yet reached the same heights as during the period of reform and opening up.

4.   Research Design

4.1.   Variables

The dependent variable in this study is "Economic Effects," with GDP being employed as a proxy to represent China's economic growth, in line with existing research findings. The number of middle school graduates is utilized as the explanatory variable.

4.2.   Data Sources

The empirical segment of the paper focuses on the analysis of China spanning from 1983 to 2006. The data utilized is sourced from the National Bureau of Statistics of China. To facilitate analysis, logarithmic transformation is applied to the empirical data. Descriptive statistics for the empirical analysis are presented in Table 1.

Table 1: Descriptive statistics.

Variable	Unit	Observations	Mean	Std.Dev.	Min	Max
GDP per capita	yuan	40	23450	25884	588	85698
GDP	Hundred million yuan	45	285311	358480	3679	1.210e+06
Middle school graduates	Ten thousand students	45	1465	339.4	950.4	2123
Number of middle school student on campus	Ten thousand yuan	45	4893	848.8	3769	6691
First industry	Hundred million yuan	45	25744	25866	1019	88345
Second industry	Hundred million yuan	45	119597	142734	1755	483165
Third industry	Hundred million yuan	45	139970	190998	905.1	638698
Investment	Hundred million yuan	40	138346	160843	1922	523890
Net export	Hundred million yuan	40	8841	10054	-679.5	39494
Consumption	Hundred million yuan	40	173162	196972	4061	641633

4.3.   Model Specification

The model employed in this study is a univariate linear regression, specified as follows:

$$Y = \alpha + \beta X + \varepsilon \tag{1}$$

In this equation, Y represents the dependent variable, which is the GDP of China, while X denotes the explanatory variable—namely, the number of middle school graduates. The term ε represents the error term or residual.

5.   Empirical Analysis

5.1.   Correlation Analysis

Figure 2 illustrates the relationship between the number of middle school graduates and Chinese GDP. As depicted in Figure 2, Chinese economic growth appears to correspond with the refinement of Chinese compulsory education. However, to validate the correlation between the evolution of

compulsory education in China and Chinese GDP, further confirmation is sought through regression analysis.
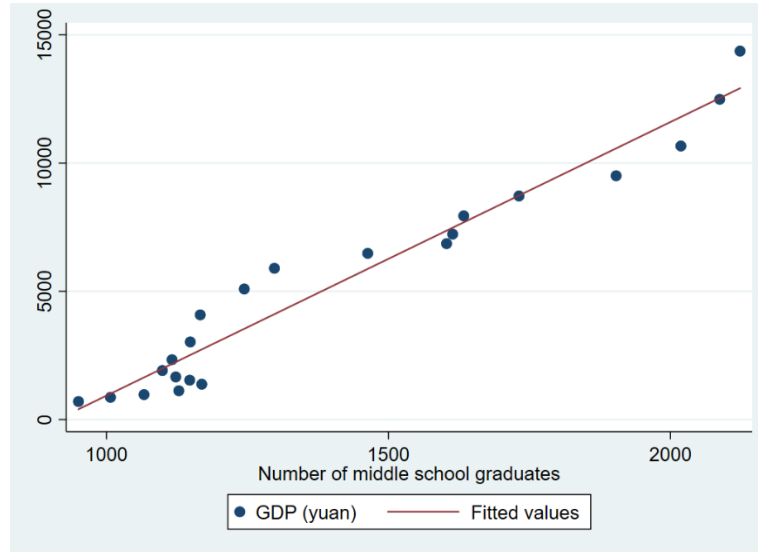

Figure 2: Correlation between the number of middle school graduates and Chinese GDP.

5.2. Baseline Regression

The regression model (1) presented in Table 2 reports the primary findings of the impact of the number of Chinese middle school graduates on Chinese GDP per capita. The estimated coefficient of the explanatory variable is 3.4727, demonstrating a statistically significant positive effect at the 1% significance level. The preliminary outcome of the baseline regression underscores the positive influence of compulsory education on the Chinese economy.

Table 2: Baseline regression and robustness test.

	(1)	(2)	(3)	(4)
	y	y	y	y
x	3.4727***	4.1795***	3.7322***	4.2172***
	(10.5144)	(9.9498)	(10.4949)	(5.0310)
_cons	-16.8676***	-27.3226***	-16.2676***	-21.4658***
	(-7.0753)	(-7.6542)	(-6.3374)	(-3.5118)
N	22	22	22	39
R^2	0.8468	0.8319	0.8463	0.4062

Note: t statistics are presented in parentheses. $^* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

5.3. Robustness Test

To ascertain the stability and reliability of the results from the baseline regression, this study employs three robustness testing approaches.

Firstly, the number of middle school graduates in China is substituted with the number of middle school students on campus—a metric indicative of the level of development of Chinese compulsory education. The results of this robustness test are presented in Table 2, model (2).

Secondly, the robustness test replaces GDP per capita with Chinese GDP, a metric reflective of the level of Chinese economic development. The outcomes of this robustness test are displayed in Table 2, model (3).

Thirdly, the year range for both sets of data is modified. By extending the year range from 1983 to 2022, a broader temporal scope is achieved, allowing a comprehensive examination of the relationship between the dependent and explanatory variables. The results of this extended-year robustness test are detailed in Table 2, model (4). Notably, R2 experiences a significant decrease in this model due to the influence of the "one-child policy" in 2006. This policy led to a decline in the number of middle school students, considerably affecting the efficacy of Chinese compulsory education and subsequently causing a decline in the goodness of fit of the model. This underscores the robustness of the initial conclusion—Chinese compulsory education exerts a positive influence on economic effects.

5.4. Heterogeneity Analysis

5.4.1. Industry

This section categorizes the Chinese economy into different industry types: First Industry, Second Industry, and Third Industry. The aim is to discern how Chinese compulsory education impacts the various sectors of the economy.

The regression models in Table 3 (1), (2), and (3) illustrate the outcomes of Chinese compulsory education's influence on each of the aforementioned industry sectors. The coefficients of the explanatory variable are 2.6088, 3.8283, and 4.2151, all demonstrating a statistically significant positive effect at the 1% significance level. The results indicate that Chinese compulsory education has the most pronounced impact on the Third Industry, followed by the Second Industry, and its influence is comparatively modest on the First Industry.

Table 3: Heterogeneity analysis of industry.

	(1)	(2)	(3)
	y	y	y
x	2.6088***	3.8283***	4.2151***
	(8.6769)	(10.1756)	(10.9669)
_cons	-9.8097***	-17.7684***	-20.8015***
	(-4.5201)	(-6.5430)	(-7.4980)
N	22	22	22
R^2	0.7901	0.8381	0.8574

Note: t statistics are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4.2. Expenditure Approach

This segment divides the Chinese economy based on expenditure approaches: Consumption, Investment, and Net Export. The purpose is to investigate how Chinese compulsory education influences different expenditure aspects of the economy.

The regression models in Table 4 (1), (2), and (3) portray the outcomes of Chinese compulsory education's influence on Consumption, Investment, and Net Export. The coefficients of the explanatory variable are 3.2766, 3.4665, and 6.7731, all exhibiting a statistically significant positive effect at the 1% significance level. The results highlight that Chinese compulsory education has the

most substantial impact on Net Export, followed by Investment, and its influence is relatively modest on Consumption.

Table 4: Heterogeneity analysis of expenditure approach.

	(1)	(2)	(3)
	y	y	y
x	3.2766***	3.4665***	6.7731***
	(8.9902)	(8.8134)	(4.6570)
_cons	-13.3850***	-15.2601***	-42.5092***
	(-5.0457)	(-5.3305)	(-4.0156)
N	17	17	17
R^2	0.8435	0.8381	0.5911

Note: t statistics are presented in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusion

Based on the comprehensive analysis presented in this study, it can be firmly concluded that Chinese compulsory education yields a positive impact on the Chinese economy. Currently, there are a few researchers who attach great significance to the relationship between Chinese compulsory education and the development of the Chinese economy. Therefore, this paper uses the time scale from 1983 to 2006 to explore it and employs three robustness tests and two types of heterogeneity analysis to test the strength of the result. Based on the characteristics of the number of graduate middle school students, the graph of trend in number of Chinese middle school graduates points out that the middle school graduates surged from 1983 to 2006 when Chinese compulsory education began to be implemented and there were a few other influential elements in the Chinese economy. The correlation analysis adopts the model to create Figure 2 by the dependent variable and explanatory variable; carries that compulsory education is indispensable to Chinese economic growth according to the regression line in the graph of correlation between the number of middle school graduates and Chinese GDP. This impact is further differentiated across various industrial sectors and expenditure approaches. Specifically, with respect to industry segments, Chinese compulsory education exerts the greatest influence on the Third Industry, followed by the Second Industry, while its effect is relatively weaker on the First Industry. Similarly, within the realm of expenditure approaches, Chinese compulsory education exhibits its most substantial influence on net exports, followed by investment, and its impact is comparatively weaker on consumption.

The insights drawn from the conclusions have several policy implications. Firstly, considering the role of Chinese compulsory education in influencing the Chinese economy, it becomes imperative for the Chinese government to prioritize the promotion of balanced and high-quality development within the compulsory education system. Secondly, there exists an opportunity for the government to enhance the curriculum content of middle school education by emphasizing the significance of the agricultural sector. Lastly, the government could facilitate a reduction in education-related expenses for parents during the compulsory education stage, thereby stimulating public consumption.

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