A Study of Quality Education and Its Impact on Industrial Leap Frogging Based on Psychological Perspectives

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Abstract: Human beings are facing a new development environment in the transformation stage of the technological and industrial revolution in the context of the new round of globalization. In China, values based on marketization and values based on local culture have different functions in human psychological adaptation, and new behavioral qualities may be formed in cultural interlacing and collision to adapt and cope with new situations brought by changes. This paper constructs the logical thread of "cognitive change - qualitative change in education - innovation enhancement - industrial leap", and deduces the transmission mechanism of improving social cognition and education to promote the change of industrial structure. The theoretical model is also empirically analyzed using 434-panel data consisting of 31 provinces in China from 2009 to 2022. The regression model of the threshold effect of education affecting industrial upgrading was constructed. The moderation effect model of psychological factors in education affecting industrial upgrading was constructed. The mediation effect model of innovation as a mediator, when education influences industrial upgrading, is constructed. It is found that there is a non-linear relationship between education quality and industrial structure, and the improvement of education quality, will bring about an industrial leap. The mechanism test shows that the improvement of the national cognitive level has a positive regulating effect on the development of education quality. At the same time, the ability of creativity plays an intermediary transferring role in education affecting industrial change.

Keywords: Cognitive Level; High-Quality Education; Industrial Change; Innovation Mediation

1. Introduction

To achieve technological self-reliance in the era of scientific and industrial revolution, China needs to develop a critical mass of innovators who can overcome technological bottlenecks and master core technologies, thereby strengthening its competitive edge in global markets. At this stage, China takes education, science and technology, and human resources as the basic and strategic support for the construction of a modernized country [1]. Therefore, the issue of high-quality education focusing on "what kind of people to cultivate" and "how to cultivate people" has become a key concern. Education, as an important part of the basic public service system, has a pioneering and guiding role in promoting industrial change and is an important influence machine for realizing industrial leapfrogging [2]. However, based on the psychological characteristics, it is worthwhile to draw research attention to the problem of thinking about education in China, the problem of educational change that needs to be faced, and the proposition of industrial change brought about by educational change. Based on this, the present study will unfold in the following two dimensions: First, from a psychological perspective, we will explore the theoretical framework and impact mechanisms through which improved education quality drives industrial leapfrogging. Second, utilizing provincial-level panel data from China, we will empirically examine the nonlinear effects of education on industrial transformation, test the threshold effect of cognitive level in education's influence on industrial transition, and investigate the moderating role of cognitive level in the process whereby education affects industrial transformation through enhanced innovation capability.

The subsequent structure of this paper is organized as follows: the second part is the literature review and theoretical analysis; the third part is the econometric model construction and data description; the fourth part is the empirical analysis; and the fifth part is the research conclusions and policy recommendations.

2. Literature Review and Theoretical Analysis

2.1 Literature Review

(I) New demands on education for high-quality economic development. The impact of education on the economy is long-standing and complex and has

always been a research hot spot. As early as 1962, the American economist Schultz first put forward the theory of human capital for economic growth, elaborating on the impact of education on the level of human capital [3]. Romer constructed a mathematical and theoretical model between the accumulation of knowledge and the industry and the economy, and found that the higher the level of human capital of the country, the more reasonable the layout of industry, and the lack of human capital investment in the backward countries, there is a "low-income trap" [4]. Subsequently, a large number of scholars have empirically examined the relationship between education and industrial structure, demonstrated the regional heterogeneity between the level of human capital and industrial structure, examined the non-linear relationship between industrial development and the level of human capital, and demonstrated that the enhancement of the level of human capital in the region can promote the upgrading of the industry, and at the same time, it will also bring about spatial spillover and so on [5].

China's reliance on unidimensional economic growth can no longer meet new development needs, and high-quality economic development and the optimization and upgrading of the entire industrial chain are the requirements and goals of the new development stage. However, at present, China's economic development has the problem of the "middle-income trap" [6], and to achieve successful economic transformation and industrial optimization and upgrading, it is necessary to cross the "middle-income trap", and it is necessary to put forward new requirements for the development of education [7]. First, from the stage of large-scale popularization of primary and higher education and expansion of the scale of education to the pursuit of a more balanced, more coordinated, more inclusive, higher quality "good education". Equity in education should be implemented in the whole process of supporting educational resources, setting the starting point of education, implementing the education process, and evaluating the results of education [8]. Secondly, the development of education from homogenized and standardized education to diversified and differentiated high-level education that takes equity into account. China's education structure at this stage has a typical pyramid-type characteristic, and the proportion of people who can enter the top of the pyramid for higher education and elite education is relatively low [9]. Thirdly, it is necessary to deal with a series of problems caused by the rapid development of education. China's education development in recent years has implemented the rapid development of higher education to pull the junior and senior high education in reverse., which will lead to the development of higher education too fast, and at the same time, there is an imbalance between the quantity of education and the quality of education, a mismatch between the supply of education and the demand for education, the structure of education is irrational, and many other sequelae of the problem [10]. The realization of the goal of high-quality education is a set of gradually improved quality systems that includes the education system, education resources, education process, education results, and so on [11].

(II) The impact of psychological cognition on education and the localization of education. The impact of psychology on education has been studied in a variety of disciplines, including psychology, education, and sociology. In 1970, Piaget proposed a theory of cognitive development that upholds the idea that the process of children's cognitive development occurs in interaction with the environment and advocates the implementation of an education that is compatible with cognitive development [12]. The theory of cognitive development is based on the idea that children's cognitive development occurs in interaction with the environment and advocates the implementation of an education that is compatible with cognitive development. In 1978, Vygotsky proposed the social learning theory, which emphasizes the cooperative nature of education and advocates the research idea that educated people are more conducive to the development of higher cognition in the process of cooperation [13]. In 2000, the self-determination theory proposed by educational psychologists Desi and Ryan emphasized the influence of intrinsic motivation on learning, believing that students are more likely to have a positive learning attitude in independent learning and choice [14]. In recent years, a large number of empirical studies have examined the impact of psychology on education. For example, students' emotional state has a significant impact on learning results [15]. Psychology can help develop the potential for sustainable thinking and can be integrated into sustainable development curricula, teaching, and assessment [16]. The psychological construction path of gifted American teenagers has its particularity [17].

In addition, there is more research controversy and concern over the localization and standardization of education. In American education, there is a more pronounced cultural issue of differentiating education for different groups, and there is a dual stance of inclusion and exclusion in educational reforms and the shaping of human beings. On the one hand, for all young children and adolescents, where education is shaped to fully reflect their morals and life expectations.

On the other hand, there is the exclusion of groups that are considered to be unsafe or dangerous [18]. China is relatively influenced by Western psychology and Soviet psychology. Western psychology focuses on the subject of micro-individuals, studying their human cognition, adaptation, traits, etc. in the market environment. Soviet psychology focuses on direction guidance, methodology, and epistemology. In China, localizing psychology is a viewpoint upheld by many scholars in recent years [19]. China is deeply influenced by Confucian culture in the process of development, and it shows strong character traits for the nature of human nature, values, psychological adjustment, and interpersonal relationships. Nowadays, there is a need to combine Chinese and foreign psychological education, localize psychological education, and build a psychological knowledge system [20].

(III) The study of the formation mechanism of psychological factors of economic subjects and the impact of psychological factors on the economy and policy is an important research topic in economics. In the theoretical study of the psychological impact on the economy, as early as 1954, psychology was introduced into the field of macroeconomic decision-making [21]. In the 1870s, psychological factors were first introduced into the analysis of economic theoretical models in the study of demand determining supply and demand in the market in the "Marginal Revolution" [22]. Keynes formally introduced psychological factors to macroeconomics and proposed the existence of irrational emotional factors in investment decision-making. Nobel Prize-winning economist Shiller pointed out that, in financial market investment, there are speculative bubbles induced by the irrational emotions of investors [23]. In modern economics, the main focus is on data-based quantitative research. Quantitative analysis methods are used to infer the logical relationship between psychological development and economic variables, such as measuring psychological development and its specific impact on the economy and policies [24]. Especially with the arrival of the big data era and the rapid development of the digital economy, massive structured and unstructured data can be involved in decision-making, and the massive data generated in the application scenarios of the Internet of Everything can feed back the psychological activities of economic subjects, which can help to quantitatively measure psychological factors. At the same time, psychological measurement based on text data and its impact on policy changes or event shocks has attracted a high degree of research attention from scholars in recent years [25].

The above literature shows that a mature analytical framework has been formed for analyzing the influence of psychological factors on education and macroeconomic subjects. However, in the process of social change, new distinctive features of individual and group psychological development are formed. It is worthwhile to pay attention to the research in this direction to develop education through the new distinctive features and the national development strategy, and to promote industrial change and upgrading.

2.2 Theoretical Analysis

(I) The impact of education on industrial development.

First of all, the pioneering role of education in the demand for talent for industrial development. China's current stage of production factor input scale trend power decline, the need to promote industrial structure optimization and upgrading through science and technology, talent, innovation, and other new kinetic energy. Education can play an important role in the stage of technological innovation and technological transformation [26]. Education can be quickly customized and targeted to train the talents needed for the development of key industries through supply-side reforms, and education can improve workers' generic human capital through supply-side reforms [27]. Education can also shape the non-cognitive traits of workers, such as stress resistance, adaptability, and learning ability, so that when workers are faced with career change and career mobility in the process of industrial upgrading, they will have stronger adaptability, which will encourage the mobility of laborers between different industries, forming a human capital agglomeration effect, and promoting the upgrading of the industrial structure. Secondly, the pioneering role of education in the upgrading of consumption. The process of upgrading the industrial structure is the process of continuously meeting the ever "higher" needs of human beings, and it is the process of upgrading consumption. Education can promote industrial upgrading through the upgrading of demand, education to cultivate a higher quality of talent, often have a higher demand for products and services, thus triggering the capital-led transfer of resources from the low-value-added market to the high-value-added market, boosting the upgrading of industrial structure [28]. Based on the analysis, hypothesis 1 is proposed: there is a positive threshold effect of education on the impact of industrial structure.

(II) The mediating role of innovation in education's impact on industrial upgrading. The process of industrial quantitative change is to achieve industrial structural adjustment at the same time, the upgrading

and optimization within each industry, from low value-added, low-processing industries to high value-added, high-quality processing industries, this process, education should be from the scale, structure, quality of synergistic promotion of industrial upgrading and development [29]. However, the development process of the industry from quantitative to qualitative change will give birth to new entities, and the industrial leap is often realized through the quantitative growth of a large number of new sectors. The new round of the Industrial Revolution is at the stage of qualitative change of industrial leap, a large number of new sectors, new combinations, and the birth of new technological systems [30]. In the process of an industrial leap, it is urgent to cultivate new industrial talents who are engaged in new sectors, new organizations, and new technological systems, and it is necessary to cultivate breakthrough and creative high-quality talents, and to break through the "neck-breaking technology" by deepening the reform of the factor market [31]. At the same time, China's industrial development has entered a new development stage of total factor enhancement, to improve the level of factors of production and output efficiency, the core is to improve the level of human capital, the level of technology, technology threshold, and tap the creative ability. At this stage, there is a large shortage of innovative talent in new sectors and new technology industries, and there is a high demand for new types of talent, such as data high literacy classes, and the scale of China's demand for big data talents will be as high as about 20 million people by 2025 [32]. Creativity is a key element in the industrial leapfrog stage and can be fostered through educational reforms focusing on collective core characteristics such as creativity and social relations. It has been found that the collective culture of characteristics is an important part of individual cultural values and that people psychologically emphasize value influence and focus on control education, which is the unique thinking of China that distinguishes it from Westerners [33]. The strong self-control trait formed in the control education and value-oriented education environment is not conducive to the cultivation of creative talents. However, Western education is more oriented towards low-control education and individuality education, and the psychological traits formed are more conducive to the cultivation of creativity [34]. China's current education can be localized by absorbing the essence of Western education, stimulating and awakening the creative ability through the establishment of a psychological support environment, creativity stimulation training, cognitive reconstruction, interdisciplinary learning, and other ways, reserving talents with creative ability for industrial leapfrogging, and promoting the upgrading of the traditional industries and the development of new industries [35]. Based on the previous analysis, hypothesis 2 is proposed: Education focuses on cultivating creative ability, which contributes to industrial leapfrogging in the information age.

(III) The moderating effect of cognitive change on education's impact on industrial upgrading. Influenced by thousands of years of Confucianism, People show unique early temperament traits, such as stronger self-control and lower emotional levels. Self-control is characterized by key traits such as persistence, obedience, shyness, calmness, and self-discipline. Among these traits such as persistence, diligence, and hard work that emphasize self-control contribute to the formation of positive social rules and a sense of mission. Meanwhile, traits of self-control such as shyness, submissiveness, and shyness are temperament traits that are not conducive to innovation and participation in a market-oriented competitive environment [36]. Therefore, psychoeducational interventions aimed at adjusting cognitive levels and levels of control are necessary. First of all, for the positive impact of psychological interventions on educators. Teachers' mental health has a significant impact on the quality of education, and mental health is the basis for effective teaching and learning. Positive psychological interventions for educators can help teachers relieve stress in their life and work, improve their cognitive level and emotional management ability in the process of social change, and assist educators in improving the quality of education [37]. Second, the optimization of psychological interventions in the educational process. The educational system can be set up to improve the overall emotional level by including cognitive behavioral therapy, emotional competence training, social skills training, home-school cooperation, and other courses. The study also found that there is a negative correlation between self-control and creativity [38]. Therefore, knowledge design and teaching design such as cognitive restructuring, positive emotion stimulation, supportive environment construction, creativity stimulation, and interdisciplinary learning can be added to the educational system setting to adjust self-control and stimulate creative thinking, imagination, and problem-solving ability of the educated. Based on the above analysis, hypothesis 3 is proposed: Positively psychological intervention has a positive moderating effect on education for industrial upgrading.

Next, China's economic development data will be used to test the research hypotheses proposed in this study.

3. Modeling and Data Description

3.1 Model

Baseline model for the optimization of industrial structure by high-quality development of education. The following benchmark linear model is constructed with the industrial structure (Stp_{it}) as the dependent variable and the level of educational development (Edu_{it}) as the core explanatory variable. Construct the following baseline linear model:

$$Stp_{it} = \alpha_0 + \lambda_0 Edu_{it} + \beta_0 Control_{it} + u_i + \eta_t + \varepsilon_{it} \quad (1)$$

In equation (1), Edu_{it} represents the education development status of province i in year t. It responds to the education development status in terms of both education scale ($Lncg_{it}$) and education quality (Esi_{it}). Stp_{it} indicated the current status of industrial structure in province i in year t. The industrial structure rationalization index ($Wisi_{it}$) and the industrial structure advanced index ($Wilpi_{it}$) were used to react to the level of industrial structure with: $Stp_{it} = (Wisi_{it}, Wilpi_{it})$, $Control_{it}$ as the set of control variables, u_i is a provincial fixed effect. η_t is a time-fixed effect and ε_{it} is a random perturbation factor.

A measure of the nonlinear relationship between education affecting the industrial structure. To test whether there is a quantitative to qualitative leap in the development of education quality to a certain extent, a nonlinear threshold effect regression model is constructed:

$$Stp_{it} = \alpha_1 + \lambda_{11} Edu_{it} I(TV_{it} \le \delta_1) + \lambda_{12} Edu_{it} I(\delta_1 < TV_{it} \le \delta_2)) + \cdots + \lambda_{1m} Edu_{it} I(TV_{it} > \delta_m) + \beta_1 Control_{it} + u_i + \eta_t + \varepsilon_{it} \quad (2)$$

Where TV_{it} is the threshold variable to measure the change in education, $I(.)$ is the indicative function, and α_i, β_i, λ_{1i}, represents the impact coefficients of education in different states, respectively. In this study, we use the scale of higher education as a threshold variable, assuming that once it reaches a certain level, it will cause a change in the quality of education.

The mediating conductive role of creative ability. In the previous analysis, innovation ability is a core literacy in the industrial leap in the information age, and to test whether educational change promotes creativity, which in turn accelerates the formation of new industries and sectors and changes the industrial structure through changes in creativity, a mediated effect model is constructed to test the impact of this mechanism:

$$Stp_{it} = \alpha_2 + \lambda_2 Edu_{it} + \beta_2 Control_{it} + u_i + \eta_t + \varepsilon_{it} \quad (3)$$

$$M_{it} = \alpha_3 + \lambda_3 Edu_{it} + \beta_3 Control_{it} + u_i + \eta_t + \varepsilon_{it} \quad (4)$$

$$Stp_{it} = \alpha_4 + \lambda_4 Edu_{it} + \xi_1 M_{it} + \beta_4 Control_{it} + u_i + \eta_t + \varepsilon_{it} \quad (5)$$

Where M_{it} indicates the mediating factor of education transmission, λ_3 is the effect of education development on the mediating variable. Coefficient ξ_1 indicates the effect of the mediating factor on industrial structure upgrading after controlling for the effect of the development of education. And coefficient λ_4 indicates the effect of high-quality education development on industrial structure upgrading after controlling for the mediating factor.

The moderating effect of cognitive level improvement to promote industrial transformation. In this paper, the cognitive level is used as a moderating variable, denoted by Clv_{it}, to construct a moderating effect model in which cognitive change brings about educational change, and educational change in turn affects industrial change:

$$Stp_{it} = \alpha_5 + \lambda_5 Edu_{it} + \gamma_1 Clv_{it} + \omega_1 Clv_{it} Edu_{it} + \beta_5 Control_{it} + \zeta_{it} \quad (6)$$

$$M_{it} = \alpha_6 + \lambda_6 Edu_{it} + \gamma_2 Clv_{it} + \omega_2 Clv_{it} Edu_{it} + \beta_6 Control_{it} + \zeta_{it} \quad (7)$$

$$Stp_{it} = \alpha_7 + \lambda_7 Edu_{it} + \gamma_3 Clv_{it} + \omega_3 Clv_{it} Edu_{it} + \xi_2 M_{it} + \zeta_{it} \quad (8)$$

If the influence coefficient of variable $Clv_{it} \times Edu_{it}$ in equation (6) is significant, it means that Clv_{it} is the moderating variable of education affecting the industrial structure, and through the coefficient ω_2 of equation (7), we can judge whether variable Clv_{it} plays a moderating role on the mediator variable creation ability and whether the influence coefficient ω_3 is significant, and judge whether the moderating variable's moderating role on the education affecting industrial structure is significant after controlling the mediator variable creation ability.

3.2 Desription of Variables

Dependent variables. The optimization of industrial structure represents, on the one hand, the rational degree of industrial structure and; on the other hand, the advanced degree of industrial development. This paper chooses the weighted industrial structure hierarchy index ($Wisi_{it}$), and the weighted industrial labor productivity index ($Wilpi_{it}$) to represent the changes in industrial structure. That is, $Stp_{it} = (Wisi_{it}, Wilpi_{it})$, and their construction formulas are as follows, respectively:

$$Wisi_{it} = \sum_{k=1}^{3} \omega_k y_{itk} \quad (9)$$

$$Wilpi_{it} = \sum_{k=1}^{3} \omega_k ln(le_{itk}) \quad (10)$$

where $\omega_k, y_{itk}, le_{itk}$ represents the weight of industries, the ratio of value added by each industry to GDP, and the labor productivity of each industry, respectively.

Explanatory variables. This paper constructs the

indicator reflecting the development of education containing the following two aspects. On the one hand, reflecting the development of the education scale, education is a state variable, which is the result of the accumulation of the previous period, using the logarithm of the number of higher education graduates to indicate the quantity of education ($Lncg_{it}$). On the other hand, the development of education quality, referring to the principle of the construction of the Thiel index, constructing the index of the education structure, which responds to the optimization of the structure of the process of the development of education, and classifying the education by the level of education as eight layers, which are an elementary school, junior high school, high school, senior college, undergraduate, graduate, doctoral and above. The weights assigned to the education structure are 1, 2, 3, 4, 5, 6, 7, 8. The education structure index is:

$$Esi_{it} = \sum_{m=1}^{8} m\, Edu_{itk} \quad (11)$$

m Denotes the level of educational attainment and represents the share of the number of people in the corresponding level. Then there are indicators of educational development.: $Edu_{it} = (Esi_{it}, Lncg_{it})$

(III) Mediating variable. Through psychological and educational intervention, one of the core objectives is to enhance the innovation ability to compete in the market and to cultivate human creativity and innovation through education, to have a stronger ability to cope with opportunities and challenges in the process of social development. Therefore, in this study, innovation and entrepreneurship are used as a mediating variable, which is represented by the ratio of urban self-employment to employment, denoted byLnp_{it} .

Moderating variable. In this study, the prevalence of mental health education was used as a metric to measure cognitive level education, expressed asClv_{it}.

Control variables. To control other factors affecting industrial structure upgrading and to be as comparable as possible with related literature in the economic field, the following control variables are selected concerning classical literature. First, to control the influence of regional economic development, the logarithm of GDP per capita is used as a control variable ($Lagdp_{it}$). Second, the restructuring and upgrading of some key industries require more fixed assets and more capital to be invested to bring in advanced technology and talents, so the logarithm of Harmonization variables investment in fixed assets (Lfa_{it}) is used as a variable to control capital investment. Thirdly, foreign investment has been uninterruptedly entering the Chinese market for decades, and the degree of openness to the outside world is an important influence variable affecting China's industrial structure and economic development, which needs to be controlled, and the share of foreign investment in GDP (Fiv_{it}) is used to represent the foreign investment variable. Fourth, new urbanization is an important element of high-quality development, and the development of demographic urbanization, economic urbanization, social urbanization, and spatial urbanization in new urbanization will all play a positive role in promoting the upgrading of the industrial structure, and in this paper, the proportion of the urbanized population to the total population (Urb_{it}) is used as a control variable for the development of the urbanization level. Fifthly, China's industrial structure is in the stage of strategic adjustment, and we have to rely on two-way guidance from the market and the government to realize the adjustment and upgrading of the industrial structure. The government participates in the process of industrial restructuring in various ways, such as through policy formulation, administrative intervention, and increasing inputs in key fields and key technologies, etc. In this paper, we use the proportion of the government's financial payment to GDP ($G\,exp_{it}$) as a control variable for the government's intervention.

3.3 Data Description

Table 1. Descriptive Statistics

Variable	Variable Properties	observed value	Mean	Std	Min	Max
Wisi	Dependent variable	434	2.042	0.242	1.472	2.798
Wilpi		434	56.692	25.621	16.269	158.88
Lncg	Explanatory variable	434	8.881	1.220	4.222	12.978
Esi		434	0.124	0.076	0.012	0.499
Lnp	Mediating variable	434	10.160	1.723	4.575	13.782
Clv	Moderating variable	434	0.6215	0.839	0.3514	0.8164
Lagdp	Control variables	434	11.253	1.070	7.627	13.401
Lfa		434	9.154	1.036	5.600	11.022
Fiv		434	0.003	0.003	0.000	0.019
Gexp		434	0.278	0.199	0.097	1.354
Urb		434	0.550	0.142	0.215	0.942

Source: China Statistical Yearbook, China Science and Technology Statistical Yearbook.

Due to the Chinese government's explicit acceleration of informatization assumptions and the rapid development of the digital economy, the digital economy has become an important engine of China's economic growth, and the contribution of the digital economy to the GDP has been increasing year by year, and the digital economy's share of the GDP has reached 40% as of 2023. China is going through a phase of industrial change. Given this, this study selects panel data consisting of 31 provinces in China from 2009-2022, which is used to test the research hypotheses proposed in the theoretical section. All variables are relative indicators; the data for education and economic development indicators come from the website of the National Bureau of Statistics, and the data for science and technology development come from the China Science and Technology Statistical Yearbook. The descriptive statistics of the variables are shown in Table 1.

4. Evidence from China

4.1 Benchmark Estimation Analysis

To test the overall impact of high-quality education development on industrial structure, the OLS model is first applied to regression, and the regression results are shown in Table 2. Column (1) is the impact of education quality on the rationalization of industrial structure, column (2) is the impact of education scale on the degree of rationalization of industrial structure, column (3) is the impact of education quality on the degree of advanced industrial structure, and column (4) is the impact of the quantity of education on the degree of advanced industrial structure. In general, the impact relationship is not significant enough to be further analyzed by nonlinear analysis.

Table 2. Basic Regression Model

Variable	(1) Wisi	(2) Wisi	(3) Wilpi	(4) Wilpi
Esi	0.039	-0.010	84.319***	-4.338***
	(0.366)	(-1.297)	(4.917)	(-3.380)
Lncg	-10.139	-11.612**	-535.548***	-739.798***
	(-1.580)	(-1.998)	(-5.137)	(-8.044)
Intercept	Yes	Yes	Yes	Yes
Con-variable	Yes	Yes	Yes	Yes
id	Yes	Yes	Yes	Yes
year	0.856	0.856	0.902	0.899
r2_a	434	434	434	434
Obs				

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

4.2 Threshold Regression

When the scale of education has developed to a certain extent, it will cause qualitative changes in the quality of education and have an impact on the adjustment of the industrial structure, and the relationship between the quality of education and the industrial structure may be non-linear. Therefore, in the empirical analysis of this paper, the size of education is used as the threshold variable, and the GMM method is applied to regression estimation of the threshold effect regression model, and the analysis results are shown in Tables 3 and 4. Table 3 shows the threshold effect test. In general, there is a threshold effect in the relationship between education quality development and industrial structure. Table 4 shows the threshold regression analysis, and the overall fitting effect of the model is satisfactory. For column (1), with education scale as the threshold variable, there is a non-linear relationship between the impact of education on industrial structure, and the effect of education structure on industrial structure is significantly negative at lower levels, and when it is greater than the threshold value of 9.565, it is conducive to increasing the level of rationalization of the industrial structure as the quality of education improves. Column (2) shows the results of the analysis of the relationship between education quality and the advanced industrial structure, in general, the improvement of education quality is conducive to the development of industrial structure to an advanced level and there is an accelerating threshold effect. For Column (3), the relationship between education scale and the rationalization level of industrial structure is positively influenced, and although there is a certain threshold acceleration effect, the acceleration effect is not obvious. For column (4), the development of the education scale is not conducive to the development of industrial structure to advanced development, the two have a negative influence relationship. In recent years, China's rapid expansion of the education scale has hindered the development of China's industrial structure to an advanced development level, basically in line with the facts of China's economic development.

Table 3. Threshold Test and Estimation

Dependent variable	Wisi		Wilpi	
Explanatory variable	Lncg	Esi	Lncg	Esi
Threshold Variables	Threshold-value 9.565	Threshold-valued 9.547	Threshold-valued 11.555	Threshold-valued 9.010
F	50.09	46.21	47.00	44.00
P	0.000	0.000	0.000	0.000

Table 4. Threshold Regression Results

Dependent Variable	(1) Wisi	(2) Wilpi	(3) Wisi	(4) Wilpi

0_Esi 1_Esi	-0.141** (-2.068) 0.177 (1.564)	62.633*** (3.457) 114.779*** (7.576)		
0_Lncg 1_Lncg			0.022** (2.158) 0.026*** (2.667)	-2.318 (-1.578) -0.772 (-0.546)
a constant	0.406*** (2.611)	-425.16*** (-20.394)	0.425*** (3.272)	-497.04*** (-25.464)
control variable	Yes	Yes	Yes	Yes
individual effect	Yes	Yes	Yes	Yes
time effect	Yes	Yes	Yes	Yes
R^2	0.781	0.900	0.784	0.886
sample size	434	434	434	434

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

4.3 Robustness Test

In the robustness test analysis, to save space, only the scale of education as the threshold variable, and the quality of education as the core impact variable, to carry out the threshold regression analysis. Considering that the four municipalities of Beijing, Shanghai, Tianjin, and Chongqing, which are provincial units composed of individual cities, have certain particularities that may lead to bias for the results of the empirical analysis, the four municipalities are excluded, constituting the first group of robustness test samples, and the results of the regression analysis are shown in Table 5, Column (1) and Column (2). At the same time, taking into account the extreme differences in the data, the first 1% of the very small value data and 1% of the very large value data are removed to form the second group of stability test samples, and the results of the regression analysis are shown in columns (3) and (4) of Table 5. The overall results of the analysis are consistent with the results of Table 4, there is a threshold effect, and the influence of the relationship and the sign of the same, the regression results are consistent with the theoretical research assumptions, indicating the robustness of the benchmark regression model constructed in this paper.

Table 5. Robustness Testing

Variable	(1) Wisi	(2) Wilpi	(3) Wisi	(4) Wilpi
0._Esi	-0.199 (-1.037)	61,122*** (3.330)	-0.176 (-0.901)	60.037** (-2.293)
1._Esi	0.138 (0.779)	100.835** (2.242)	0.161 (0.890)	101.970** (2.163)
constant	0.474** (2.397)	-393.57*** (-15.700)	0.509** (2.482)	-403.93*** (-15.505)
Con-var	Yes	Yes	Yes	Yes
individual	Yes	Yes	Yes	Yes
time	Yes	Yes	Yes	Yes
R^2	0.765	0.889	0.759	0.886
size	430	430	425	425

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

4.5 Heterogeneity Analysis

To test whether there is regional heterogeneity in the impact of high-quality development of education on industrial structure, this study divides the data into three categories: the east, the west, and the central, and repeats the construction of the threshold regression model respectively, and the estimation results are shown in Table 6.

The results of the classification review show that the relationship between the development of the quality of education and the industrial structure in the three regions is the same as in the country as a whole, except for differences in the coefficients of influence. Relatively speaking, the higher the level of education, the smaller the change of education in industrial structure, which is in line with the "convergence hypothesis". In regions with a lower level of educational development, the influence of education on industrial structure is positive, but the degree of influence will gradually converge, which further illustrates the importance of educational reform.

Table 6. Heterogeneity Analysis

	The east		Central Region		The west	
Variable	(1)	(2)	（3）	（4）	(5)	(6)
	Wisi	Wilpi	Wisi	Wilpi	Wisi	Wilpi
0._Esi	-0.226* (-1.85)	37.462*** (5.142)	-0.251* (-1.768)	38.912* (1.920)	-0.42* (1.659)	66.256** (2.033)
1._Esi	0.03** (2.271)	102.773*** (5.375)	0.158* (1.761)	98.158* (1.871)	0.031** (2.096)	131.557*** (3.860)
Con-var	Yes	Yes	Yes	Yes	Yes	Yes
individual	Yes	Yes	Yes	Yes	Yes	Yes
time	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.759	0.886	0.863	0.951	0.784	0.931
size	168	168	126	126	140	140

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

4.4 The Mechanism Analysis

(I) Mediating effects of innovation. Using innovation and entrepreneurship as a mediating variable, we empirically test whether there is a mediating effect, and the results of the analysis are shown in Table 7. Column (1) shows the total impact of education quality on industrial structure, using education scale as a threshold variable, and the results of the analysis are consistent with the findings of the impact in the above section, and there is a "U" shaped impact relationship. Column (2) shows the impact of education quality on

innovation and entrepreneurship, and column (3) shows the impact of education on industrial structure after controlling for innovation and entrepreneurship. Through the analysis, the following insights are obtained: First, education on innovation and entrepreneurship is also a non-linear influence relationship, and the degree of influence of education on innovation and entrepreneurship is much higher than the influence of education on industrial structure. Secondly, innovation is a mediating variable affecting industrial structure, and the coefficient of the joint influence of education on industrial structure is larger after adding the mediating variable than that without the mediating variable, which indicates that education changing industrial structure through innovation and entrepreneurship is an optimization path for industrial structure upgrading.

Table 7. Analysis of Mediating Effects

Variable	(1) Wisi	(2) Lnp	(3) Wilpi
0._Esi	-0.146** (-2.116)	-10.761*** (-3.717)	-0.141** (-2.068)
1._Esi	0.173*** (2.537)	1.351** (2.238)	0.177*** (2.564)
Lnp			-0.003*** (-2.347)
constant	0.426*** (2.974)	-6.378*** (-8.294)	0.406*** (2.611)
Con-var	Yes	Yes	Yes
individual	Yes	Yes	Yes
time effect	Yes	Yes	Yes
R^2	0.781	0.914	0.781
sample size	434	434	434

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

Table 8. Analysis of Coordinating Affects

Variable	(1) Wisi	(2) Lnp	(3) Wisi
Esi	1.133** (2.398)	18.760*** (6.301)	1.460*** (2.955)
Clv	0.040 (1.352)	1.039*** (5.527)	0.058* (1.894)
Esi*Clv	0.157** (2.376)	2.611*** (6.276)	0.202*** (2.932)
Lnp			0.017** (2.157)
control variable	-14.943** (-2.233)	-113.755*** (-2.697)	-16.925** (-2.518)
individual effect	Yes	Yes	Yes
time effect	Yes	Yes	Yes
R^2	Yes	Yes	Yes
sample size	0.857	0.923	0.859
control variable	434	434	434

Note: ***, **, * indicate significance levels of 1%, 5%, and 10%, respectively; t-values in parentheses.

(II) Moderating effects of cognitive change. Cognitive level by accelerating education from the scale of development to high-quality development change, to provide a matching human capital base for economic transformation, the analysis results are shown in Table 8, Column (1) to test whether the cognitive level plays a moderating role in the process of high-quality education affecting the adjustment of industrial institutions, column (1) analysis results of the cross terms of education quality and social cognitive level, at the significance level of 5% is significantly positive, which indicates that cognitive level plays a positive moderating role in education quality affecting industrial structure adjustment, and enhancing education level through psychological intervention is an effective way to optimize industrial structure. Column (2) is whether cognitive level plays a moderating role in innovation and entrepreneurship which has a mediating effect, and the results of the analysis show that the cross term of cognitive level and education quality is significantly and positively related to innovation and entrepreneurship at the 1% level of significance. Column (3) tests whether cognitive level has a moderating effect after adding the mediating variable, and the results of the analysis show that at the 5% significance level, the cross term of cognitive level and quality of education affects industrial restructuring through the mediating variable of innovation and entrepreneurship.

5. Conclusion and Countermeasures

5.1 Conclusion

Based on China's 2009-2022 data, this paper analyzes the theoretical assumptions and empirical tests of the impact of cognitive change on education quality and industrial change, and the study obtains the following conclusions: (1) education has a positive impact on industrial upgrading pulling effect, and its impact is non-linear when the scale of education has developed to a certain extent there is a positive promotion of the quality of education, and there is a positive promotion of industrial change. (2) The higher the level of education in the region, the smaller the change of education in the industrial structure, the lower the level of education development in the region, education change in the industrial structure of the impact of the role of significant. This suggests that it is only through the qualitative change of education that the leap of industry can be brought about after the development of education to a certain level. (3) The psychological cognitive level changes in the process of social change, and positive cognitive change has a positive moderating effect on improving the quality of

education and then promoting industrial upgrading. (4) At the present stage, the improvement of education quality has a positive impact on innovation ability, and education quality accelerates industrial leapfrog through the improvement of innovation ability.

5.2 Countermeasures

The following insights were gained through the research in this paper:

First, positive and targeted psychological interventions can help improve the quality of education. In the era of rapid change, it is necessary to give sufficient attention and support to psychological construction and mental health, systematically incorporate psychological cognitive capacity building in education reform, and promote the improvement of China's education quality by combining moral education rooted in traditional Chinese culture and the instructive and supportive education mainstreamed in the West in psychological cognitive capacity building.

Secondly, enhancing innovation capacity and promoting high-level technology development through education reform is an effective way to realize industrial upgrading. The results of empirical analysis show that education can influence the upgrading of industrial structure by enhancing innovation and entrepreneurship. Education should clarify what kind of people are needed for industrial development and fundamentally solve the problem of "how to train people". We should implement high-quality education from the perspective of system construction, cognitive restructuring, positive emotion stimulation, supportive environment construction, creativity stimulation, interdisciplinary capacity building, etc., to vigorously cultivate innovative talents needed in a new era, to promote innovation and entrepreneurship development, to promote the development of high-level industrial clusters, high-end manufacturing industry and modern service industry, and to fundamentally solve the core problem of industrial structure upgrading.

Third, building an education system that serves high-quality industrial development. The construction of the education system focuses on supply-side reform to meet the diversified, hierarchical, and personalized education needs at this stage; the implementation of education policies should take into account regional differences, urban and rural differences, and formulate education implementation policies following local conditions; on the education assessment system, following the new meaning of high-quality education, we should broaden the dimensions of education evaluation, and incorporate quality education, frustration education, and fair education into the education assessment system to enhance the efficiency and comprehensiveness of training, to make the training of talents "sufficient, capable and useful", and to meet the new era's demand for talents. In the education assessment system, the efficiency and comprehensiveness of cultivation are enhanced, so that the cultivated talents are "useful enough, useful and good enough" to meet the new demands for talents in the new era.

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