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Higher Education, Technological Innovation, and Green Development—Analysis Based on China's Provincial Panel Data

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Abstract: Higher Education and technological innovations have so far proved to be key factors of regional green development as they have been seen to contribute greatly to economic growth and environmental protection. On the other hand, higher education positively supports technological innovation by offering knowledge production and transformation. The majority of the studies being conducted around this have focused more on promoting regional green development by backing the importance of technological innovation and the reinforcement of talent reserve in higher education. However, very few studies have been dedicated to pointing out specific ways in which higher education influences regional green development. In this study, based on provincial panel data for 2003–2020 in China, both the direct and in-between effect of higher education on green development was evaluated using the mediation effect model. Then a panel threshold model was created to explore the regional differences in this effect in China. Key results show that higher education significantly promotes regional green development, and technological innovation plays an in-between role in the above-mentioned influence relationships; there is significant diversity among regions with different developing levels of technological innovation, and the positive impact of higher education on green development in educationally developed provinces gradually decreases, while this positive impact in educationally developing provinces keeps rising. Specific policy recommendations to promote regional green development for higher education mainly include further balancing investment in higher education, coordinating the development of higher education and technological innovation, and strengthening the flow of resources among provinces.

Keywords: higher education; technological innovation; green development; intermediary effect; regional heterogeneity

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1. Introduction

Growing industrial activities have brought great pressure on the environment in most countries around the globe, which has resulted in a potentially harmful impact on the sustainable development of both the economy and society. The President of the People's Republic of China, Xi Jinping, proposed promoting green development and building an environment-friendly society in the Twentieth National Congress of the Communist Party of China in 2022. Since China entered the "new normal", green development has been a new economic model which requires both economic growth and environmental improvement.

In terms of achieving green development, scholars now focus on the role played by knowledge compilation and technological innovation. Education, to be specific higher education, is seen as an important factor affecting the compilation of knowledge and innovation [1,2]. China has attached great importance to the implementation of human resource strategy, as it is seen as a crucial societal aspect. According to the data published by the National Education Bureau, the proportion of government expenditure on education in the gross domestic product (GDP) has kept increasing year by year since 2012, reaching 4.22% in 2020. Higher education has gradually increased the accumulation of human capital

and helped promote technological innovation by spreading knowledge and promoting skills, which has further improved green development.

Higher education encourages technological innovation by improving the quality of the labor force, which also contributes to regional green development directly by improving the employment of local residents [3,4]. Furthermore, higher education creates a knowledge stock that can promote technological innovation by encouraging firms and individuals to step into technology-intensive industries [5,6]. However, there are realities, such as the weak applications of knowledge stock and the imbalance of regional higher education development, which significantly affect technological innovation. Under the idea of realizing regional green development through higher education construction and technological innovation, it is of great importance to explore the relationship between higher education and green development in greater depth.

The main focus of this paper is to look at the impact of higher education through technological innovation by promoting knowledge stock on regional green development. The following issues are studied in this paper: what is the development level of regional higher education, innovation in technology, and green development in China? How does higher education affect regional green development, and what role does technological innovation play? Is there regional diversity caused by the imbalance of regional education development?

2. The Literature Review and Theoretical Analysis

2.1. The Literature Review

2.1.1. The Influence of Higher Education on Green Development

Schultz identifies the importance of education in economic growth as early as the 1960s by measuring the contribution of education to economic growth in the United States to be around 30% [7]. Kitaura argues specifically for the higher education dimension that expanding higher education increases personal income and encourages physical capital accumulation, thus expanding productive knowledge through implementation and operation [8]; Borrelli and Peng et al. verify that higher education plays a positive role in promoting regional economic growth and improving social cohesion in several countries, such as the United States, Spain, and China [9,10]; Ahmed N et al. empirically test, using data from 1995–2020 for the countries of Mexico, Indonesia, Nigeria, and Turkey, and confirm that high-educated workforces are essential in mitigating carbon dioxide (CO_2) emissions and developing of global green economy [11].

However, a large gap exists between China and other developed countries. Higher education in various provinces shows uneven development, which leads to significant inter-regional differences in the development effect on the economy [12]. Most academicians insist that higher education can promote economic development in China. Zhang measured the efficiency of green development at the city level in China from 2007–2016 and found that regional education showed a considerable positive effect on the level of regional green development [13]. Furthermore, some scholars have pointed out the role that higher education in China plays in showing regional differences. Liu H. et al. suggest that the differences lie both in the quantity and quality of educational resources in China; thus, the impact of human capital level on high-quality economic development shows regional diversity [14]. Wang explores the causal mechanism of higher education on economic development in each province and verifies that higher education will promote high-quality economic development due to abundant educational opportunities and the transformation of educational outcomes. However, due to educational investment or the lack of transformation of educational outcomes, higher education cannot support the regional high-quality economic development [15].

2.1.2. The Influence of Higher Education on Technological Innovation

The impact of higher education on technological innovation has been a hot topic. In this light, most studies have confirmed the positive effect of higher education on technological

innovation [16]. Ricard proposes a Nielsen–Phelps-type mechanism of action of human capital, arguing that human capital indirectly promotes the economy, mainly through promoting the level of technological innovation growth [17]. Additionally, Benhabib verifies the role of education in promoting technological innovation in several countries around the world. Liu studies different education levels in China by structure and finds that the Nielsen–Phelps-type mechanism is better confirmed at the higher education level, and its role in promoting economic growth is more crucial than that of the secondary education [18]. Lu validates that higher education cultivation in China's regions extends a noticeable effect on regional innovation level, and the level of higher education and innovation shows a similar regional imbalance [19]. Zhao investigates that higher education in China's provinces can further promote economic growth by promoting the level of technological innovation. Zhao's research also shows the spillover effect of technological innovation in the Yangtze River Delta region [20].

2.1.3. The Influence of Technological Innovation on Green Development

For the importance of technological innovation on green development, most scholars mention that the improvement of the level of technological innovation has led to progress in technology, thus promoting green development. Brian highlights that the advantage of green development in developed countries is that they pay more attention to the research and development of green technologies [21]. Nataraja believes that in order to achieve green and sustainable development, developing countries should pursue a green, low-carbon, cyclic, and efficient development model and timely eliminate backward, inefficient, and polluting production technologies [22,23]. Luo verifies the importance of technological innovation in enhancing the competitiveness of enterprises and maintaining sustainable development from the perspective of the enterprise technological innovation [24]. Xiao points out that the level of higher education, technological innovation, and regional economic development in China both promote and limit each other [25]. Hou finds that the gap between technological innovation and the greening level in China gradually becomes smaller in space distribution, and technological innovation can play a significant positive influence on the regional green development level through the knowledge spillover effect and human capital effect [26].

Some scholars have studied the dimension that technological innovation can improve energy use efficiency. Lorek finds that cities with higher levels of innovation are better suited to improve fossil energy consumption and promote the development of a green economy [27]. Aricò also points out that technological innovation will play a major role in addressing the increasingly serious global warming problem, and it is necessary to adhere to the concept of green development and use new energy development technologies to maintain sustainable development [28,29]. In addition, Huang and Yao et al. verify that technological innovation can effectively solve the current resource shortage problem in China from three aspects: green ecology, green production, and green living. The energy consumption structure restricts the efficiency of green innovation in China's industry, and technological innovation is the basic driving force and important support for the green development [30,31].

2.1.4. Summary of the Previous Research

To sum up, through sorting out the existing literature on higher education, technological innovation, and green development at home and abroad, it is found that most of the research is only based on the study of higher education, technological innovation, and green development. Although it has been relatively in-depth, there is no research analysis and empirical test on the impact of the three, so the policy recommendations are not comprehensive. China's green development is at the stage of rapid growth. The technological innovation talents trained by higher education can transform the technological innovation achievements, and the optimization of the innovation environment and the promotion of green technology can also improve the output efficiency of the green economy,

continuously release the innovation momentum, and help to achieve the sustainability of economic development. Therefore, it is of great significance to explore whether the current level of higher education and technological innovation in China can have a positive impact on green development and whether the sustainability of green development can be achieved.

2.2. Mechanism Analysis

2.2.1. Direct Effect of Higher Education on Green Development

Modern education is the most important way of human capital formation and development, which guarantees the improvement of scientific and cultural levels as well as the increase in knowledge of regional nationals and has a significant contribution to the formation and progress of moral values. Schultz's theory of human capital states that higher education is an investment in human capital, a demand created to cater to economic growth [7]. As an important part of the education system, higher education is both a continuation and development of primary and secondary education, which is an important link between educational activities and socio-economic activities.

(1) At the micro level, higher education is an important way to grow the social value of individuals and renew their beliefs. Higher education continues to develop the logical quality of human capital from compulsory education, serving as a transition period for individuals to turn to socio-economic activities at the same time, which is a key pathway to increasing individual employment gains. In terms of the social value that individuals can create, education can cultivate different aspects of the comprehensive quality of individuals at different stages. The more individuals receive higher education, the richer the human capital with technological knowledge, professional production experience, and labor skills, the higher the social value that can be created, and the more labor productivity there continuously will be to improve and promote the economic and social development [32]. In terms of ideology, the social and cultural environment of the region affects economic and social development to a certain extent. Green development is not only limited to economic growth but also includes the cultivation of green consciousness of society and the social and cultural atmosphere of the common development of the green economy. Higher education cultivation helps to improve the moral quality and spiritual outlook of people, which can better accept new ideas and new things and drive the people around to update their ideology together, create a social and cultural atmosphere of green development for all people, as a result creating the basic requirements for green development [33].

(2) From the macro level, higher education is an important method to cultivate professional human capital and optimize the allocation of labor resources. Romer deepens the impact of human capital on economic growth in the new economic growth theory that the accumulation of specialized knowledge can generate incremental effects and increase the returns of other input factors, thus making the total scale of return incremental, which, in turn, illustrates that specialized human capital is a modern economic growth [34]. From a factor resource allocation perspective, different stages of education and training have impacted economic development differently [35]; deepening higher education and training has been conducive to enriching the knowledge stock of labor, improving the supply structure of labor, meeting the demand for different kinds of labor for economic and social development, and realizing the optimal allocation of labor resources [36].

Accordingly, hypothesis 1 is proposed: higher education has a positive contribution to green development.

2.2.2. Indirect Effect of Higher Education on Green Development

(1) The indirect effect of higher education on green development is mainly seen through technological innovation, and the realization of green development cannot be achieved without the innovation and development of green environmental protection and production technology. Firstly, the improvement of higher education is better suited to promote the combination of science and education. From the perspective of new economic

growth theory, technological innovation has been the necessary driving force to promote economic growth; education is the basic force of technological innovation, and the education process at different stages provides the necessary human capital and knowledge stock for technological innovation; green development is closely related to green technological innovation, and the level of social knowledge stock will affect the innovative products. The level of social knowledge stock affects the demand for innovative products and the benefits brought by innovation. Secondly, both intellectual capital and human capital have a strong combination effect, and higher education cultivation creates a group of compound intellectuals for society while improving social knowledge stock, which is conducive to stimulating the generation of frontier technological theories and innovative ideas, accelerating the transformation of knowledge achievements, improving independent innovation capability, and reducing innovation path dependence [37]. Finally, higher education supports the flow of technology using the knowledge-spreading effect and knowledge spillover effect, which can reduce the uneven level of technological innovation among regions.

Subsequently, technological innovation can improve the efficiency of resource utilization and improve the energy consumption structure [38,39]. The improvement of technological innovation level can strongly develop green innovation and green environmental protection technology, reduce the loss in the process of energy use, develop new green energy technology, reduce the cost of energy use, promote the transformation and upgrading of industrial structure to the green industry [40,41]. It can also cultivate new economic momentum, promote the sustainable coordination of a green economy and ecological environment, and achieve green development. Secondly, technological innovation can cultivate a green lifestyle and implement low-carbon life. Technology improves the human lifestyle. The landing of green technology accelerates the green transformation of lifestyle and consumption, while the promotion of the green life concept strengthens people's awareness of pollution prevention and control, which together help the construction of ecological civilization [42].

Accordingly, hypothesis 2 is proposed: higher education can promote green development through technological innovation.

(2) However, it is worth pointing out that there are indirect fears in the promotion of education to the economy in addition to its economic effect on education investment, which is also limited by the stage of regional development [43,44]. Higher education may promote green development through technological innovation, and this impact may show inconsistency depending on the level of technological innovation. In reality, higher education cultivation and technological innovation development do not achieve complete synchronous science and education integration. At a lower level of technological innovation, moderate–higher education cultivation can fully stimulate and motivate the innovation of groundbreaking subjects that can realize the synergistic growth of higher education and technological innovation. While at a higher level of technological innovation, the economic level usually indicates slow growth, and at this time, a continuous increase in higher education cultivation may result in the phenomenon of education deepening, i.e., oversupply of composite human resources and over-saturation of the job market, which would lead to the lack of vitality of innovative subjects and a limited role of higher education in promoting green development through technological innovation.

Accordingly, hypothesis 3 is proposed: the positive influence of higher education on green development will be influenced by technological innovation, thus showing a non-linear effect, and this non-linear effect shows regional heterogeneity.

To sum up, higher education can promote green development through technological innovation while directly promoting green development, and the direct effect of higher education will also receive the differential impact of technological innovation. Figure 1 shows the mechanism between higher education, technological innovation and green development.

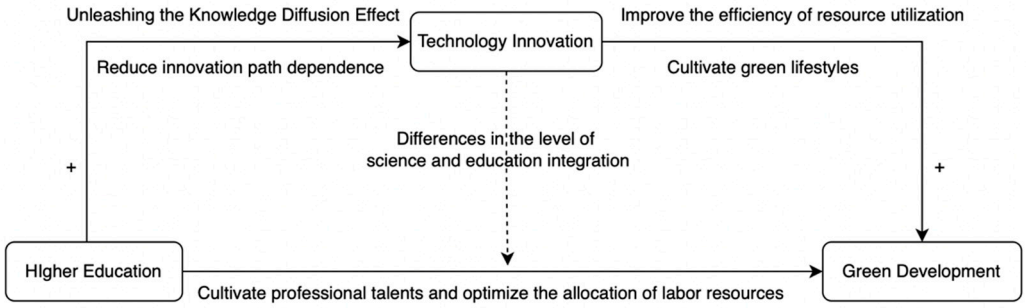

Figure 1. Mechanism of action diagram.

2.3. Research Framework

To determine the interrelationship between higher education and green development, we collected data from 2003 to 2020 from 31 provinces in China. First, we constructed the influence mechanism of higher education, technological innovation, and green development through the literature and theoretical research; then, we constructed a green development system from two aspects (economic development subsystem and environmental society construction subsystem) and selected the corresponding indexes to represent higher education and technological innovation. Based on the three indexes, we studied the trend of higher education, technological innovation, and green development in 31 provinces. Secondly, we applied the mediation effect model to determine the mediating effect of technological innovation in higher education acting on green development. Further verification of the mediating effect of technological innovation by region was obtained. Thirdly, the threshold effect of technological innovation was tested by applying the threshold effect model. It was then determined that technological innovation possesses a significant threshold effect in the path of higher education and is also influenced by regional education level while acting on green development. Finally, conclusions were drawn in the full text by trying to provide scientific suggestions for achieving the coordination of higher education, technological innovation, and green development among 31 provinces. Figure 2 briefly illustrates the framework of this study.

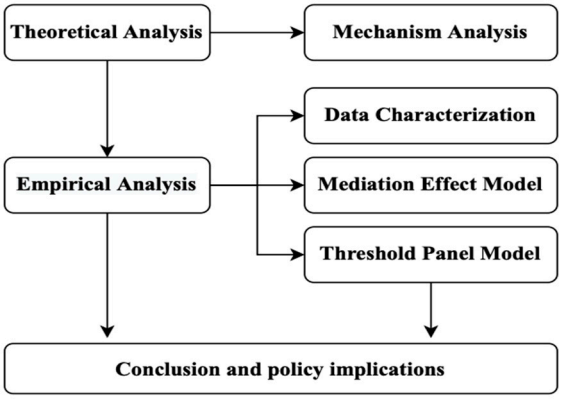

Figure 2. Overview of research framework.

3. Materials and Methods

3.1. Model Specifications

3.1.1. Mediation Effect Model

The theoretical analysis illustrates the direct effect of higher education on green development as well as the mediation effects created by technological innovation. Inspired by the existing research [45], this paper uses the stepwise test regression to test the mediation effect and constructs the following mediation effect model:

$$Green_{it} = \alpha_0 + \alpha_1 Education_{it} + \alpha_2 controls_{it} + \varepsilon_{it} \quad (1)$$

$$Innovation_{it} = \beta_0 + \beta_1 Education_{it} + \beta_2 controls_{it} + \theta_{it} \quad (2)$$

$$Green_{it} = \gamma_0 + \gamma_1 Education_{it} + \gamma_2 Innovation_{it} + \gamma_3 controls_{it} + \mu_{it}. \quad (3)$$

In Formula (1), the total effect of higher education on green development is tested as the first step. If the coefficient is significant, then Formula (2) is used to test the effect of higher education on scientific and technological innovation as the second step. If the coefficients of both Formulas (1) and (2) are significant, then the third step is taken to test the mediation effect by using Formula (3). The mediation effect exists only if the coefficients of all three formulas are significant.

3.1.2. Threshold Panel Model

The regional heterogeneity of the impact of higher education on green development is not only related to the level of investment in higher education but also affected by regional differences in technological innovation. Therefore, this paper uses the threshold panel model to explore the beginning of technological innovation in terms of its impact on the relationship between higher education and green development. In Formula (4), y_{it} is the explanatory variable, x_{it} is the explanatory variable, which can also be used as a threshold variable, q_{it} is the threshold variable, and η_1 is the threshold value being estimated. $I(\cdot)$ is the indicative function, which takes the value of 1 when the condition in afterthoughts is satisfied and 0 in the opposite case.

$$y_{it} = u_{it} + \beta_1 x_{it} I(q_{it} \le \gamma) + \beta_2 x_{it} I(q_{it} > \gamma) + e_{it} \quad (4)$$

To test hypothesis 3, that is, how the promotion effect of higher education on green development will differ under different technological innovation levels, we draw on the threshold regression model, with technological innovation as the threshold variable and regional higher education level as the core explanatory variable, to test the differential impact of higher education on green development under the limitations of different technological innovation levels. Combined with the research in this paper, the threshold model is constructed as Formula (5), where γ is the threshold value to be estimated.

$$\begin{aligned} Green_{it} = {} & \alpha_1 + \beta_1 Education_{it} I(Innovation_{it} \le \gamma) \\ & + \beta_2 Education_{it} I(Innovation_{it} > \gamma) + \varepsilon_{it} \end{aligned} \quad (5)$$

Formula (5) is only a model with a single threshold, and there may be multiple thresholds in the actual test, so the model is constructed as in Formula (6) (with a double-threshold model as an example).

$$\begin{aligned} Green_{it} = {} & \alpha_1 + \beta_1 Education_{it} I(Innovation_{it} \le \gamma_1) \\ & + \beta_2 Education_{it} I(\gamma_1 < Innovation_{it} \le \gamma_2) \\ & + \beta_3 Education_{it} I(Innovation_{it} > \gamma_2) + \varepsilon_{it} \end{aligned} \quad (6)$$

3.1.3. The Spatial–Temporal Entropy Weight Model

The spatial–temporal entropy weight model can effectively use the information of indicators in the dual dimensions spatially and temporally compared to the traditional entropy weight method. Suppose the indicator system contains k indicators, n research objects, and the time span is m periods. Then, the indicator system is $X_i (i = 1, 2\cdots, k)$; then, the value of the indicator in period t is $X_{ijt} (j = 1, 2\cdots, n)$, so that the value of X_{ijt} after standardization is X'_{ijt}, the information entropy of each indicator is expressed by D_i, the weight of each indicator is expressed by W_i, and the specific formula is as follows. In Formula (9), p_{ijt}=$X'_{ijt} / \sum_j \sum_t X'_{ijt}$, and if $p_{ijt} = 0$, then $\sum_t p_{ijt} \ln(p_{ijt}) = 0$. Considering that there are n regions and k variables of the green development system, then the green development system matrix X can be established, as shown in Equation (11):

$$X'_{ijt} = \left[X_{ijt} - \min(X_{ijt})\right] / \left[\max(X_{ijt}) - \min(X_{ijt})\right] \ (X_i \text{ is positive}) \quad (7)$$

$$X'_{ijt} = \left[\max\left(X_{ijt}\right) - X_{ijt}\right] / \left[\max\left(X_{ijt}\right) - \min\left(X_{ijt}\right)\right] \ (X_i \text{ is negative}) \quad (8)$$

$$D_i = -\ln(mn)^{-1} \sum_j \sum_t p_{ijt} \ln\left(p_{ijt}\right) \quad (9)$$

$$W_i = (1 - D_i) / \left(k - \sum_i E_i\right) \quad (10)$$

$$X = \sum_k X'_{ijt} * W_i \quad (11)$$

3.2. Data

3.2.1. Explained Variable

Scholars generally believe that green development has multiple dimensional implications, including socioeconomic performance, ecological protection, and resource reservation. Estella applied a green growth measurement indicator system, including 12 basic indicators, to evaluate green growth in OECD and Korea [46]. Shang constructed an indicator system covering 12 basic indicators relating to economic development, social progress, ecological protection, and energy consumption [47]. Inspired by prior research, we established a preliminary index system of green development, including 12 basic indicators that point to economic development and environmentally social construction (Table 1). Furthermore, the weight of each indicator was determined by the time–space range entropy weight method, which is specifically introduced in Section 3.1.3 in this paper.

Table 1. Indicators system for green development level.

System Layer	Standard Layer	Indicator Layer	Indicator Direction
Economic development Sub-system	Economic vitality	Per capita GDP (yuan) (×1)	+
		Disposable income of urban residents (yuan) (×2)	+
	Industrial structure	Advanced index of industrial structure (×3)	+
		Rational index of industrial structure (×4)	+
	Regional balanced development	Ratio of residents' consumption level to the national level (%) (×5)	+
		Ratio of urban population (%) (×6)	+
Environmentally society construction sub-system	Environmental protection	Ratio of MSW treatment (%) (×7)	+
		Industrial wastewater discharge per unit of GDP (tons/person) (×8)	−
		SO_2 emissions per unit of GDP (tons/person) (×9)	−
	Green lifestyle	Energy consumption per unit of GDP (tons/person) (×10)	−
		Per capita Green area (hectare/person) (×11)	+
		Per capita water resources (m^3/person) (×12)	+

3.2.2. Core Explanatory Variable

The government's cost of higher education almost covers the whole investment in higher education in China, determining the development level and regional difference of higher education in each province. Drawing on previous studies, this paper selects government expenditure per capita on higher education as the representation of higher education.

3.2.3. Control Variables

Inspired by the existing research, this paper set finance, Opening open, and FDI as the control variables. Here, finance is the financial structure expressed by the ratio of the loan balance and deposit balance of financial institutions. Open is the opening level expressed by the ratio of total regional imports and exports to GDP, while FDI is the foreign capital utilization level, expressed by the ratio of regional foreign investment proportion to GDP.

3.2.4. Mediate Variable

The mediate variable used in this research was technological innovation (TI), expressed as the number of patent authorizations per capita. With reference to the prior research, higher education is the key factor to technological innovation by serving knowledge production and transformation [48]. Because of the technology innovation, economic development is highly promoted while protecting the environment and effectively improving regional green development.

Taking provinces as decision-making units and 30 provinces, municipalities, and autonomous regions in mainland China as the sample set, this paper estimated the effect that higher education has on regional green development. All the data were collected from the China Statistical Yearbook, Education Statistics Yearbook from 2004 to 2021, and the statistical yearbook of each province. All the data sets were further normalized through the method of addressing data with extreme differences clarified as Formulas (7) and (8) in Section 3.1.3. Table 2 summarizes the statistics of all variables.

Table 2. Descriptive statistics.

Variables	N	Mean	Sd	Min	Max
Green	540	21.24	9.81	5.94	60.17
Innovation	540	7.41	11.13	0.13	74.38
Education	540	6.01	7.36	0.37	61.37
Finance	540	0.76	0.13	0.45	1.16
Open	540	0.31	0.37	0.01	1.72
Fdi	540	0.49	1.48	0.05	32.90

4. Empirical Results

4.1. Variable Statistics

The calculation results of all dimensions of green development presented an upward trend in the 31 provinces, and this trend was basically the same as that of technological innovation and higher education (Figure 3). Additionally, the spatial characteristic of green development, technological innovation, and higher education had a similar pattern. Specifically, central provinces, such as Beijing, Tianjin, and Shanghai, had quite a high degree of all three dimensions, while provinces, such as Inner Mongolia, Liaoning, and Guangxi, had quite a low degree. In 2012, the level of green development, technological innovation, and higher education in all provinces showed a certain degree of growth. Green development and technological innovation were better improved in such provinces as Zhejiang, Fujian, and Hainan, while higher education in these provinces showed a small increasing trend, which implied a significant regional heterogeneity. In 2020, green development, technological innovation, and higher education in all provinces showed a significant improvement. However, because they lagged in regional economic and educational development, the provinces, such as Jiangxi, Yunnan, and Guizhou, showed a weaker increasing trend in all three dimensions, and a regional imbalance of technological innovation was significantly vaster in that year. The gap between technological innovation and higher education was further widened, implying a phenomenon that higher education lagged behind [19]. The preliminary results showed that green development is spatially associated with regional development of technological innovation and higher education. Meanwhile, these results were preliminary and consistent with the opinion of the "Matthew effect", that regional imbalance is wider since higher education and technological innovation get promoted faster in developed regions, while those in developing regions get promoted slower [49].

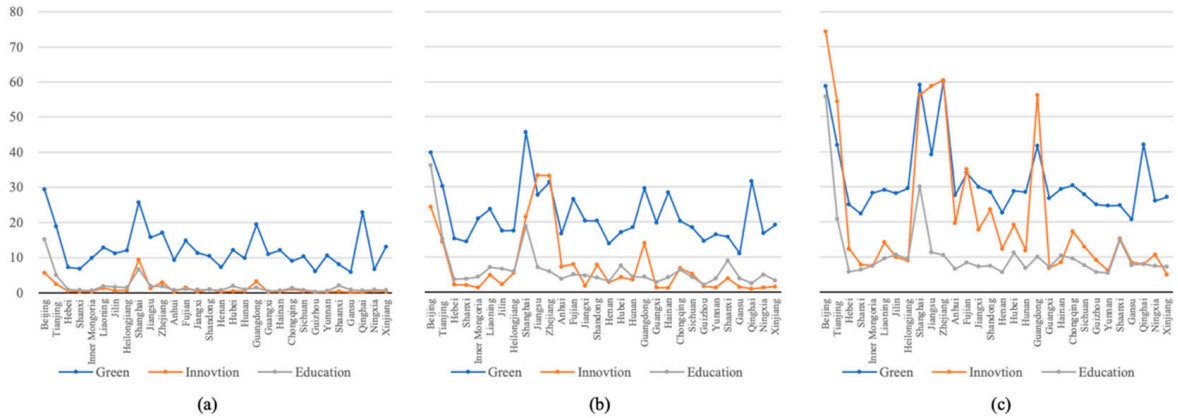

Figure 3. The developing trend of main variables in years 2003 (**a**), 2012 (**b**), and 2020 (**c**).

4.2. Results of Mediation Effects

The results of the mediation effects regression are shown in Table 3. Columns (1) and (2) represent the impact test of higher education on green development and higher education on technological innovation, respectively. It can be seen that the core explanatory variable is significantly positive with a coefficient of 1.190, meaning that higher education significantly promotes regional green development, which is in line with hypothesis 1, that higher education has a positive contribution to green development. In column (2), it can be seen that the coefficient of higher education is significantly positive, indicating that higher education can significantly encourage technological innovation. Column (3) represents the mediate effect of technological innovation on green development; it can be seen that the coefficients of higher education and technological innovation are both significantly positive, with coefficients of 0.828 and 0.287, respectively. It is worth noting that the direct effect of higher education on green development is 0.828, and the indirect effect of technological innovation on green development is 0.362, indicating that technological innovation partly plays an in-between role, which is in line with hypothesis 2, that higher education can promote green development through technological innovation.

Table 3. Results of Mediation Effects.

Variables	(1)	(2)	(3)
	Green	Innovation	Green
Education	1.190 *** (−0.374)	1.260 *** (−0.135)	0.828 * (−0.405)
Innovation			0.287 *** (−0.089)
Finance	16.90 ** (−6.354)	9.896 ** (−4.578)	14.06 ** (−5.711)
Open	−1.448 (−3.964)	−20.9 1*** (−4.982)	4.554 (−3.552)
Fdi	−0.152 ** (−0.070)	−0.0731 (−0.084)	−0.131 (−0.085)
_cons	1.729 (−2.987)	−1.283 (−4.027)	2.098 (−2.946)
Time-fixed effects	Y	Y	Y
Province-fixed effects	Y	Y	Y
Adjusted R-squared	0.689	0.731	0.726
Number of observations	540	540	540

Notes: *, **, *** indicate that the statistical test is significant at the 10%, 5%, and 1% levels, respectively.

It can be found that higher education directly has a strong effect on green development, while the indirect effect of promoting green development through technological innovation

is weaker. Since China has attached great importance to the cultivation of higher education, the role it has played through technological innovation in green development still needs to be strengthened. The reasons may be as follows. Firstly, the investment in higher education will create knowledge stock and improve the quality of the labor force for quite a long time. Therefore, higher education, which is represented by investment, cannot improve regional technological innovation immediately, thus having quite a weak indirect effect on green development through the technological innovation [50,51]. Secondly, regional imbalance of higher education and technological innovation significantly affect the transformation and application of knowledge stock and technological innovation, thus making the effect on green development become weaker, especially in provinces with lower higher education investment.

4.3. Results of Robustness Tests

To further support the above conclusion, this paper has also adopted the method of dividing the 31 provinces into two groups by using formulas (1) to (3) to regress. Inspired by the existing research, this paper chose provinces in which the proportion of government expenditure on education in the gross domestic product is more than 20% as educationally developed provinces, while the rest were classified as educationally developing provinces [52]. The results of robustness tests are shown in Table 4.

Table 4. The results of group regression.

Variables	Educationally Developed Provinces			Educationally Developing Provinces		
	(1)	(2)	(3)	(1)	(2)	(3)
	Green	Innovation	Green	Green	Innovation	Green
Education	0.181 *** (−0.049)	0.894 *** (−0.093)	0.109 ** (−0.052)	1.421 *** (−0.409)	2.836 *** (−0.889)	0.830 *** (−0.23)
Innovation			0.0768 *** (−0.028)			0.208 *** (−0.080)
Finance	−3.376 (−2.436)	−0.972 (−1.228)	−4.230 * (−2.266)	−6.977 ** (−3.333)	−25.30 *** (−5.747)	−1.708 (−2.122)
Open	−4.733 *** (−1.029)	−21.26 *** (−2.555)	−3.091 ** (−1.283)	0.0533 (−1.247)	−25.39 *** (−3.746)	5.341 ** (−2.663)
Fdi	−2.992 *** (−1.082)	0.0337 (−2.465)	−3.048 *** (−1.073)	−0.254 *** (−0.097)	−0.416 *** (−0.127)	−0.168 ** (−0.071)
_cons	37.07 *** (−2.942)	26.19 *** (−9.568)	36.18 *** (−2.933)	11.22 *** (−2.245)	19.36 *** (−4.459)	7.187 *** (−1.541)
Time-fixed effects	Y	Y	Y	Y	Y	Y
Province-fixed effects	Y	Y	Y	Y	Y	Y
Adjusted R-squared	0.982	0.923	0.982	0.95	0.846	0.958
Number of observations	270	270	270	270	270	270

Notes: *, **, *** indicate that the statistical test is significant at the 10%, 5%, and 1% levels, respectively.

It can be found that higher education significantly promotes regional green development, and technological innovation intermediately affects regional green development in both educationally developed provinces and educationally developing provinces. Specifically, according to the results of Table 4, the indirect impact coefficient of higher education on green development in educationally developed provinces and educationally developing provinces are 0.069 (38%) and 0.59 (42%), respectively. The results show that the coefficient of the core explanatory variable is always significantly positive in two groups, further validating the robustness of the conclusions herein. Educationally developed provinces generally have higher technological innovations because they attract more investment and a labor force with higher quality. However, the effect coefficient of higher education on green development in these provinces is significantly lower than those in the remaining

provinces. These results can be explained by the decreasing marginal effect played by education investment on both technological innovation and green development, making the effect coefficient in educationally developing provinces smaller than those in educationally developed provinces.

4.4. Results of Threshold Tests

To further find the regional heterogeneity, we establish a threshold panel model incorporating technological innovation to determine the threshold in terms of the effect of higher education on regional green development. The number of the threshold is determined by the threshold effect test, as shown in Table 5. In order to test the authenticity and reliability of the results, the likelihood ratio function of the threshold is drawn in Figure 4. It can be seen that when the threshold value is within the confidence interval, the LR statistic approaches zero, which proves that the threshold value is reliable. There are double thresholds in the whole 31 provinces, 19.16 and 39.26. In addition, the double thresholds in educationally developed provinces are 17.26 and 37.12, while there is a single threshold for technological innovation in educationally developing provinces, namely, 5.93. The results implied that less higher-education investment in the low-education developed regions could achieve the purpose of encouraging technological innovation to promote regional green development.

Table 5. Results of threshold tests.

	31 Provinces	Educationally Developed Provinces	Educationally Developing Provinces
Single threshold test	19.16 ***	17.26 ***	5.93 ***
Double thresholds test	39.26 **	37.12 **	0.17
Triple thresholds test	0.39	10.02	2.23

Notes: **, *** indicate that the statistical test is significant at the 5%, and 1% levels, respectively.

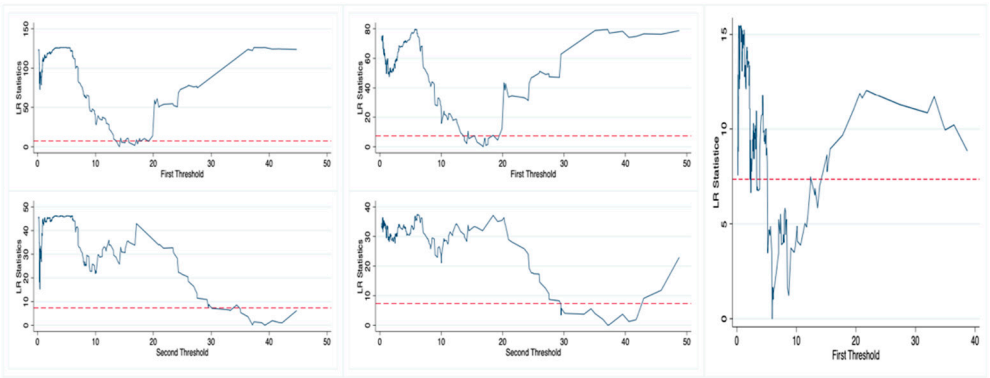

Figure 4. Results of threshold tests of (**a**) 31 provinces, (**b**) educationally developed provinces, and (**c**) educationally developing provinces.

This verifies hypothesis 3 that technological innovation plays a non-linear effect on the pathway of higher education acting on green development, and this non-linear effect shows regional heterogeneity. This may be a result of the following: (1) In the educationally developing provinces, less knowledge output results or insufficient innovation motivation of innovative subjects, resulting in the inconsistent pace of synergistic development of higher education and science and technology innovation, the human resource output of higher education is higher from improving individual employment returns and optimizing market labor allocation to promote green development so that it can play an active role in green development under the lower level of technology innovation development; (2) The stock of knowledge in educationally developed provinces is richer, and the increase in number of professional and skilled talents makes the transformation of knowledge achievements

more convenient, as well as the requirements for technological innovation level which are higher, so the marginal effect of human capital on green development is less than that in areas with a low education level.

Based on the results of the threshold effect test shown in Table 5, further empirical estimation of the influence coefficients were conducted under the threshold of technological innovation in all 31 provinces and the two groups, as shown in Table 6. When innovation is less than the first threshold, the first threshold is 14.14 in 31 provinces, 16.80 in educationally developed provinces; the coefficients of higher education on green development are 1.98 and 1.71, respectively, while in educationally developing provinces, the threshold is only 5.93, and the coefficient is as high as 2.68. This indicates that higher education can positively contribute to green development, and innovation can develop synergistically with higher education at a much lower level in educationally developing provinces. This may be because: (1) In educationally developing provinces, the synergistic development of higher education and technological innovation is not uniform in pace due to less knowledge output results or insufficient innovation motivation of innovative subjects, and the human resource output of higher education is more to promote green development from improving individual employment returns and optimizing market labor allocation. Hence, it can positively contribute to green development at a lower level of technological innovation; (2) For educationally developing provinces, the investment of higher education funds showed more direct results. The rising trend of human capital and knowledge stock is more significant, and the effect of promoting green development through technological innovation is more obvious.

Table 6. Results of threshold model regression.

Variables	Conditions	31 Provinces	Educationally Developed Provinces	Educationally Developing Provinces
First threshold value		14.14	16.80	5.93
Second threshold value		39.26	37.12	-
Education	$Innovation \leq \gamma$			2.68 ***
	$Innovation > \gamma$			3.01 ***
Education	$Innovation \leq \gamma_1$	1.98 ***	1.71 ***	
	$\gamma_1 < Innovation \leq \gamma_2$	1.45 ***	1.27 ***	
	$Innovation > \gamma_2$	1.15 ***	0.99 ***	
Finance		7.63 ***	10.84 ***	−6.92 ***
Fdi		−0.23 **	0.90	−0.39 ***
Open		−8.25 ***	−9.50 ***	1.91
Cons		7.70 ***	6.35 ***	14.30 ***
F value		317.51	199.64	371.80

Notes: **, *** indicate that the statistical test is significant at the 5%, and 1% levels, respectively.

When innovation is greater than the first threshold and lower than the second threshold, the second threshold is 39.26 in 31 provinces and 37.12 in educationally developed provinces, and the coefficients of the effect of higher education on green development are 1.45 and 1.27, respectively. There is no second threshold in educationally developing provinces, and the coefficient of the effect of higher education on green development is 3.01. When innovation is greater than the second threshold, the coefficients of the effect of higher education on green development are 1.15 and 0.99 in 31 provinces and educationally developed provinces, respectively, and the marginal effect of higher education on green development decreases further at this time. The effects of higher education on green development can be seen, as they gradually decrease in 31 provinces and educationally developed provinces, while the impact coefficient of higher education in educationally developing provinces increases significantly. This may be a result of the following: (1) the knowledge stock in educationally developed provinces is richer, and the capital investment is kept higher for a long time, or the scale of education keeps expanding. However, the

actual economic operation process of education cultivation and economic development does not achieve completely synchronous growth; (2) With the gradual stabilization of economic growth, the employment market demand shows a trend of shrinking, but the composite talents are still being exported in large quantities, and the contradiction between the two is getting bigger, and the phenomenon of "devaluation of education" has appeared. The increase in professional and skilled personnel makes the transformation of knowledge achievements more convenient, and the requirement of technological innovation level is also higher and gradually decreases with the increase in technological innovation level, yet still shows positive promotion effect on green development.

5. Conclusions and Policy Implications

Based on the data collected from 31 provinces and regions from 2003 to 2020, this paper focused on the impact of higher education on regional green development. The main conclusions of this study were as follows: (1) Higher education, technological innovation, and green development have significantly increased during the research period. The spatial characteristic of higher education and technological and green development had similar patterns that some eastern provinces and regions were at high levels, while western provinces and regions were at low levels; (2) Higher education actively promoted regional green development, while technological innovation showed a significant positive intermediary effect between higher education and green development. However, the indirect impact of higher education through technological innovation was less than the direct impact of higher education on green development; (3) The threshold effect of technological innovation existed on the impact of higher education on green development, and this threshold effect differed among provinces with various levels of education development. The marginal effect of higher education investment had shown a decreasing trend in the 31 provinces, especially in the educationally developed provinces.

From these research findings, policy implications can be drawn to consider the goals of promoting regional green development through higher education and technological innovation. The first point to consider here is that government education, as the main way of human capital education and training, can make up for the insufficient investment of individuals and enterprises in education. The government should take different measures to improve the imbalance of higher education development among 31 provinces and strive to achieve equal opportunities in education. Specifically, the government of educationally developing provinces should levy additional focus on the education development measures, such as improving educational infrastructure and setting up special funding to attract a high-quality labor force. The government of educationally developed provinces should improve the quantity and quality of higher education investment and encourage technological transformation by optimizing the allocation of higher education resources. Moreover, each industry is inseparable from the support of continuous technological innovations. Green development requires the continuous optimization of the green technological innovation environment and the continuous input and output of green technological innovation. It is essential to optimize the coordinated development of higher education and technological innovation. Each province should actively promote the flow of innovative human sources and technological innovation between universities and enterprises, as well as encourage college–enterprise cooperation to improve the transformation of knowledge stock. In addition, green development should be a comprehensive and coordinated systematic development; the role of inter-provincial factors flowing in promoting regional green development has not yet reached the ideal level. Hence, each province should pay more attention to the inter-provincial corporation and try to break regional barriers to make full use of the spillover effects of knowledge dissemination, as well as the agglomeration and scale effect of green industries. Specifically, measures, such as increasing R&D Corporation between universities and enterprises and encouraging innovation incubation, are to be taken in order to enhance the role of higher education in technological innovation, economic growth, and people's life improvement.

6. Research Limitation and Future Research

The main contributions of the article are as follows: First, it broadens the research framework of green development and provides a new reference basis for the realization of green development through the development of higher education in China; Second, the systematic research of higher education, technological innovation, and green development has been improved, and the non-linear relationship between higher education and green development under different technological innovation levels has been discussed; Finally, it expands and analyzes the non-linear impact of higher education on green development under different levels of education, and provides important theoretical and practical value for more targeted improvement of higher education, technological innovation, and development of the sustainable green economy.

Although this research has made some achievements, it also has some limitations. Due to the limited data, this study did not include the structure of higher education in the scope of study and did not explore the impact of higher education and technological innovation on the green development of different industries. In future research, we need to expand data sources, refine research objects, conduct an in-depth analysis of the differences in the structure of higher education in various provinces and cities, explore the performance of higher education and technological innovation in different industries, and pay attention to the differences in green development in different regions. The current research can be copied to other regions and economies. In future research, we will further compare the differences in the impact of higher education and scientific and technological innovation on green development between China and other economies and put forward suggestions for promoting the coordinated, green development of higher education and scientific and technological innovation in China.

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References

1. Chen, S.; Golley, J. 'Green' productivity growth in China's industrial economy. *Energy Econ.* **2014**, *44*, 89–98. [CrossRef]
2. Yawen, S.; Qingquan, J.; Iqbal, K.S.; Manzoor, A.; Hui, L. Do higher education research and development expenditures affect environmental sustainability? New evidence from Chinese provinces. *Environ. Sci. Pollut. Res. Int.* **2021**, *28*, 66656–66676.
3. Geng, M.; Tian, H. Research on the Coupling and Coordination between Higher Education and Industry and Its Economic Effect ——Empirical Analysis Based on Inter Provincial Panel Data and Spatial Dubin Model. *Chongqing High. Educ. Res.* **2023**, *2*, 1–14.
4. Liu, L.; Ding, T.; Wang, H. Digital Economy, Technological Innovation and Green High-Quality Development of Industry: A Study Case of China. *Sustainability* **2022**, *14*, 11078. [CrossRef]
5. Liu, X. Integration of Higher Education into National Technological Innovation System: Approaches, Mechanisms and Policy Support. *Educ. Res.* **2018**, *39*, 113–121.
6. Sarwar, S.; Alsaggaf, M.I.; Tingqiu, C. Nexus Among Economic Growth, Education, Health, and Environment: Dynamic Analysis of World-Level Data. *Front. Public Health* **2019**, *7*, 307. [CrossRef]
7. Vaizey, J.; Schultz, T.W. Investment in Human Capital. *Econ. J.* **1972**, *82*, 787. [CrossRef]
8. Kitaura, K.; Yakita, A. School Education, Learning-by-Doing, and Fertility in Economic Development. *Rev. Dev. Econ.* **2010**, *14*, 736–749. [CrossRef]

9. Borrelli, B. Education and economic growth in the United States: Cross-national applications for an intra-national path analysis. *Policy Sci.* **2008**, *41*, 183–204.
10. Peng, S.; Wu, M. Study on the Coupled and Coordinated Development of Higher Education Scale and Regional Economy in China. *Stat. Decis.* **2021**, *37*, 109–112.
11. Ahmed, N.; Sheikh, A.A.; Hassan, B.; Khan, S.N.; Borda, R.C.; Huamán, J.M.C.; Senkus, P. The Role of Educating the Labor Force in Sustaining a Green Economy in MINT Countries: Panel Symmetric and Asymmetric Approach. *Sustainability* **2022**, *14*, 12067. [CrossRef]
12. Yang, T.; Liu, Z. Comparative Analysis of the Contribution of China's Higher Education to Economic Growth. *J. High. Educ. Manag.* **2014**, *8*, 7–16.
13. Zhang, Q.; Lin, Y. How does Education Affect Green Development Efficiency under the "Internet Plus"Background? Empirical Analysis Based on Data of 264 Prefecture-Level Cities. *Educ. Econ.* **2021**, *37*, 3–10+28.
14. Liu, H.; Yu, Y.; Jiang, W. Blockchain Technology, Educational Resource Differences, and High-quality Development of the Economy —An Empirical Analysis Based on the Distribution of Higher Education Resources in China. *J. Shaanxi Norm. Univ. (Philos. Soc. Sci. Ed.)* **2020**, *49*, 145–158.
15. Wang, S.; Gao, Y. The Multiple Paths of High Quality Development of Regional Economy Supported by Higher Education. *Chongqing High. Educ. Res.* **2022**, *11*, 1–16.
16. Du, W.; Yang, Z. Study on the mechanism of the role of human capital in driving economic growth. *China Soft Sci.* **2014**, *08*, 173–183.
17. Nelson, R.R.; Phelps, E.S. Investment in Humans, Technological Diffusion, and Economic Growth. *Am. Econ. Rev.* **1966**, *56*, 69–75.
18. Liu, Z.; Hu, Y.; Xianzhong, Y. Testing for the Mechanism of Impacts of Heterogeneous Human Capital on Economic Growth. *J. Quant. Technol. Econ.* **2008**, *4*, 86–96.
19. Lu, Y.; Hu, J. Analysis of the impact of China's regional higher education development level on regional innovation—Based on data from 31 provinces, cities and autonomous regions in China. *China High. Educ. Res.* **2010**, *10*, 24–27.
20. Zhao, R.; Du, Y. The Impact of Higher Education and Quality of Human Capital on "Local-Neighborhood"Economic Growth. *J. High. Educ. Manag.* **2020**, *41*, 52–62.
21. Copeland, B.R.; Taylor, M.S. Trade and the Environment: A Partial Synthesis. *Am. J. Agric. Econ.* **1995**, *77*, 765–771. [CrossRef]
22. Natarajan, U.S.; Gujja, B. Green economy: Policy framework for sustainable development. *Curr. Sci.* **2011**, *100*, 961–962.
23. Liu, J.; Zheng, S. Research on Technical Efficiency Change and Influence Factors of Chinese Industrial Green Development:Based on the Analysis of the Input-Output Table. *Urban Environ. Stud.* **2019**, *21*, 37–54.
24. Luo, S.; Yu, Y. Technology Transfer, "Returnees" and Enterprise Technology Innovation: An Empirical Study in China's Photovoltaic Industry. *J. Manag. World* **2012**, *11*, 124–132.
25. Xiao, S.; Liu, J. The Coordinated Development Analysis about the Science-Technology Innovation Ability of Regional Higher Education. *Econ. Geogr.* **2018**, *38*, 124–131.
26. Hou, C.; Cheng, Y.; Ren, J.; Chen, Y. Mechanism of the Effect of Science and Technology Innovation on Regional Greenization Based on Green Economic Efficiency and Spatial Econometrics. *Sci. Technol. Manag. Res.* **2017**, *37*, 250–259.
27. Lorek, S.; Spangenberg, J.H. Sustainable consumption within a sustainable economy–beyond green growth and green economies. *J. Clean. Prod.* **2014**, *63*, 33–44. [CrossRef]
28. Arico, S. The contribution of the sciences, technology and innovation to sustainable development: The application of sustainability science from the perspective of UNESCO's experience. *Sustain. Sci.* **2014**, *9*, 453–462. [CrossRef]
29. Wang, Y.; Qu, L.; Wang, J.; Liu, Q.; Chen, Z. Sustainable Revitalization and Green Development Practices in China's Northwest Arid Areas: A Case Study of Yanchi County, Ningxia. *Land* **2022**, *11*, 1902. [CrossRef]
30. Huang, J.; Li, L. Ecological urbanization and its eco-technology innovation drive. *J. Manag.* **2013**, *26*, 22–27.
31. Yao, X.; Niu, C.; Liu, J. Innovation Driven, Green Growth and Industrial Economic Efficiency. *Forum Sci. Technol. China* **2015**, *01*, 57–62.
32. Yang, M.; Liu, K.; Wu, X. Educational Human Capital, Healthy Human Capital and Green Technology Innovation—The Moderating Effect of Environmental Regulation. *Rev. Econ. Manag.* **2021**, *37*, 138–149.
33. Zhang, G.; Liu, R. Comparison and Evaluation of Chinese Regional Operational Eficiency and Environmental Eficiency Based on Environmental Corporate Strategy. *J. Stat. Inf.* **2015**, *30*, 51–59.
34. Romer, P.M. Increasing Returns and Long-Run Growth. *J. Political Econ.* **1986**, *94*, 1002–1037. [CrossRef]
35. Petrakis, P.E.; Stamatakis, D. Growth and educational levels: A comparative analysis. *Econ. Educ. Rev.* **2002**, *21*, 513–521. [CrossRef]
36. Yang, Y.; Wu, D.; Xu, M.; Yang, M.; Zou, W. Capital misallocation, technological innovation, and green development efficiency: Empirical analysis based on China provincial panel data. *Environ. Sci. Pollut. Res. Int.* **2022**, *29*, 65535–65548. [CrossRef]
37. Shang, Y.; Lyu, G.; Mi, Z. Green Technology Transfer, Environmental Regulation, and Regional Green Development Chasm: Based on the Empirical Evidence from Yangtze River Delta. *Int. J. Environ. Res. Public Health* **2022**, *19*, 13925. [CrossRef]
38. Luigi, A.; Teemu, M.; Paolo, V.C. Do research and development and environmental knowledge spillovers facilitate meeting sustainable development goals for resource efficiency? *Resour. Policy* **2022**, *76*, 102603.
39. He, W.; Wen, J.; Zhang, M. Research on the Impact of Digital Economy Development on China's Green Ecological Efficiency: Based on Two-way Fixed Effects Model. *Econ. Probl.* **2022**, *1*, 1–8, 30.

40. Yi, S.; Zou, C. Assessing Transformation Practices in China under Energy and Environmental Policy Goals: A Green Design Perspective. *Sustainability* **2023**, *15*, 2948. [CrossRef]
41. Chen, M.; Chen, R.; Zheng, S.; Li, B. Green Investment, Technological Progress, and Green Industrial Development: Implications for Sustainable Development. *Sustainability* **2023**, *15*, 3808. [CrossRef]
42. Shen, S.; Xu, R.; Chen, F. Spatial disequilibrium and convergence of high-quality development of green low-carbon circular economy in China. *China Bus. Mark.* **2023**, *2*, 1–13.
43. Hou, D. Comments on Recent Thoughts about China's "Demographic Dividend Disappearance and Aging Crisis". *Popul. Res.* **2011**, *35*, 29–40.
44. Ma, J.; Hu, Y. The Scale Efect and Turning Point of China's Higher Education in the New Development Stage. *Jiangsu High. Educ.* **2022**, *01*, 19–28.
45. Wen, Z.; Chang, L.; Hau, J.; Liu, H. Testing and application of the mediating effects. *Acta Psychol. Sin.* **2004**, *05*, 614–620.
46. Kim, S.E.; Kim, H.; Chae, Y. A new approach to measuring green growth: Application to the OECD and Korea. *Futures* **2014**, *63*, 37–48. [CrossRef]
47. Shang, Y.; Liu, S. Spatial-Temporal Coupling Coordination Relationship between Urbanization and Green Development in the Coastal Cities of China. *Sustainability* **2021**, *13*, 5339. [CrossRef]
48. Hoc, L.H.; Trong, N.D. University-industry linkages in promoting technology transfer: A study of Vietnamese technical and engineering universities. *Sci. Technol. Soc.* **2019**, *24*, 73–100. [CrossRef]
49. Guo, L.; Zhang, N. The Coordinated Development of Higher Education and Regional Economy. *Heilongjiang Res. High. Educ.* **2018**, *36*, 43–48.
50. Chen, W.; Shen, T. Exploring the time lag in the interaction between higher education structure and industrial structure. *Heilongjiang Res. High. Educ.* **2012**, *30*, 73–76.
51. Li, Z.; Wang, H. Spatial Aglomeration and Spilover Efects of Higher Education on Regional Economy Growth in China—Empirical Evidence from Provinces Delineated in "One Belt One Road". *Res. High. Educ. Eng.* **2021**, *05*, 121–127.
52. Du, X.; Shen, B. Study on the Allocation of Public Educational Resources. *Theory Pract. Educ.* **2010**, *30*, 18–21.