Research on the Influence Mechanism of China's Natural Capital Investment on Economic Growth – Empirical Analysis Based on 30 Provincial Panel Data

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Abstract: This paper studies whether and how natural capital investment can become a new driving force for economic growth that promotes the construction of ecological civilization. The Cobb-Douglas production function model is extended, adding natural capital investment variables, and hypotheses: one is that natural capital investment directly promotes economic growth, and the other is that natural capital investment indirectly promotes economic growth through human capital channels. Finally, empirical regression is carried out on China's provincial panel data from 2006 to 2020 to test the direct and indirect impact mechanisms of natural capital investment on economic growth, as well as the existing regional differences. Natural capital investment not only directly promotes economic growth, but also promotes the accumulation of human capital, which in turn promotes economic growth indirectly. The forestry investment and ecological restoration and treatment investment in the eastern and central regions have a more obvious role in promoting economic growth, and the investment in industrial pollution control and urban environmental infrastructure construction investment in the western and northeastern regions have a more obvious role in promoting economic growth. Therefore, it is necessary to make overall design, rational planning, increase investment in natural capital, and inject new kinetic energy into economic growth.

Keywords: natural capital investment; economic growth; extended Cobb-Douglas production function; direct effect mechanism; indirect effect mechanism

JEL Classification: O33; O44

1. Introduction

The great success of China's economy over the past four decades has been built on the basis of massive consumption and waste of natural resources, destruction and sacrifice of the ecological environment. In 2020, the soil erosion area in my country is 2.6927 million km², accounting for 28.15% (The data comes from Bo (2021, June 8)) of the national land area. As of 2014, the national desertified land area was 2.6116 million km², accounting for 27.2% of the total land area; The total area of desertified land in the country is 1.7212 million square kilometers, accounting for 17.93% of the total land area (The data comes from Tu Zhifang, & Sun Tao (2016)). The new growth journey must take into account the depletion of natural capital, which is difficult to replace and prone to irreversible tipping points and collapse (Stern et al., 2020). The Chinese government pledged to the world on September 22, 2020 that carbon emissions will peak by 2030 and

carbon neutrality will be achieved by 2060 (Xinhua News Agency (2022, March 3)). This means that China's investment structure and national wealth will change, and more and more investment will flow into the field of natural capital.

Growth is driven by capital accumulation. As far as the impact of natural capital on economic growth is concerned, most scholars have analyzed theories or theoretical models, regarded natural capital as an input factor of economic output, and attached importance to the connection between natural capital and other capitals (Bi, 2004; Shi & Liu, 2004). Some scholars have conducted data analysis based on China's actual situation, and the results show that China's natural capital and economic growth are closely related (Hu & Wang, 2005; Zhao, 2012; Qi et al., 2015; Xue et al., 2016; Yang, 2017; Ma et al., 2017). However, there are few and limited studies on the impact of natural capital investment on economic growth. Pan (2019) systematically analyzed the mechanism of ecological, economic and social effects of agro-ecological capital investment. The research of Yu et al. (2020) shows that the double growth of GDP and natural capital can be achieved through natural capital investment. The above literature has deepened our understanding of the importance of natural capital, but most studies regard natural capital as a constraint rather than a driving factor, ignoring the multi-dimensional characterization of natural capital investment and ignoring the contribution of natural capital investment to economic growth.

The marginal contribution of this paper is that, first, it tries to answer whether natural capital investment has an impact on economic growth, and proposes the direct and indirect effects of natural capital investment on economic growth. Second, select the panel data of 30 provinces and cities from 2006 to 2020 for empirical analysis to verify that natural capital investment not only directly promotes economic growth, but also promotes the accumulation of human capital, which in turn promotes economic growth indirectly.

2. Methodology

When analyzing economic growth, Solow's economic growth model is generally used, and the production function is the Cobb-Douglas (C-D) production function. When discussing the impact of natural capital investment on economic growth, the impact of physical capital on economic growth should also be added. Therefore, we divide capital investment into fixed asset investment K and natural capital investment E, and introduce natural capital investment into the production function. The newly expanded economic growth model is shown in Formula 1 as follows:

$$Y_t = A(t)f(K_t, E_t, L_t) = A(t)K_t^{\beta}E_t^{\alpha}L_t^{\gamma} \tag{1}$$

After taking the logarithm of both sides of the formula, draw on the research idea of Yu (2015), use natural capital investment to replace the log value of total factor productivity, and other influencing factors are included in the random error term of the measurement equation, and the conduction variable X is used to calculate the factor of production. Simple substitution, to get:

$$lnY_t = f(lnK, lnE, lnX) \tag{2}$$

$$lnX = f(lnE_t) \tag{3}$$

According to Formula 2 and Formula 3, the hypothesis to be verified in the empirical part of this paper is proposed:

Hypothesis 1: Natural capital investment directly promotes economic growth.

Hypothesis 2: Natural capital investment brings human capital accumulation, and human capital can promote economic growth, so natural capital investment indirectly promotes economic growth through human capital channels.

Drawing on the ideas of Yan (2012), Acemoglu et al. (2014) and Ma (2017), the measurement equation is set as shown in Formula 4:

$$lnY_{it} = alnL_{it} + blnK_{it} + \alpha_1 lnFI_{it} + \alpha_2 lnEI_{it} + \alpha_3 lnWI_{it} + \alpha_4 lnCI_{it} + \mu_{it} \tag{4}$$

Among them, direct natural capital investment is measured by forestry investment (*FI*) and ecological restoration and treatment investment (*EI*), and indirect natural capital investment is measured by industrial pollution control investment (*WI*) and environmental infrastructure construction investment (*CI*). i represents the province, t represents the year, and μ represents the random disturbance term.

According to the measurement model established above, relevant data on economic growth, fixed asset investment, natural capital investment and human capital indicators are required. The characterization and specific meanings of each variable are as follows:

- Economic growth: Y. Economic growth is the explained variable, and the per capita gross domestic product (GDP) or its logarithm of each province, city and region is selected as the measure.
- Natural capital investment: E. As the core explanatory variable, natural capital investment is an important basis for empirical analysis. Here, natural capital investment is divided into direct investment and indirect investment. Based on data availability, it can be represented by the following data: First, forestry investment (FI) and ecological restoration and governance investment (EI), which aim to directly invest in natural capital and increase the Stocks improve quality, improve the stability and restoration of natural ecosystems, and create more ecosystem products and services. The second is investment in industrial pollution control (WI) and investment in environmental infrastructure construction (CI), which aim to slow down or reduce the waste of natural capital and reduce the negative externality of environmental pollution. Renewable energy investment should be one of the important indicators. Due to the lack of investment data for most provinces, cities and regions, it was not included as a measure.
- Forest coverage rate: forestcover. As the main body of the terrestrial ecosystem, forests not only provide human beings with forestry products such as timber, but also can effectively improve the ecological environment. The forest coverage rate here is represented by the ratio of forest saving area to each province, city or region.
- Human capital: L. There are two common ways to measure human capital: one is the proportion of education expenditures in government financial expenditures, and the other is the average years of education. Referring to the methods of Liu (2014), Yang et al.

(2016), and Ma (2017) to measure human capital, the average years of education are used to measure human capital. By summarizing, sorting, and calculating the data of the "China Statistical Yearbook", it is divided into five parts: illiterate, primary school, junior high school, high school, college and above. The years of education are 0, 6, 9, 12, and 16 years respectively. The calculation formula is as follows: Average years of education = (number of primary school graduates * 6 + number of junior high school graduates * 9 + number of high school graduates * 12 + number of college graduates and above * 16) is divided by (number of people aged six and above), you can get the human capital of each province and city for 15 years changes.

- Physical capital: K. my country's economic growth is highly dependent on fixed asset investment, and China's past economic growth was largely driven by fixed asset investment (Zhao, 2011). The empirical results are more realistic.

- In order to make the empirical results more accurate, the "urban" control variable of urbanization level is also added, which can affect economic growth to a certain extent and is expressed by the urbanization rate.

The empirical analysis uses the cross-sectional data of 30 provinces, cities and regions (excluding Tibet) in the country from 2006 to 2020. The data comes from the "China Statistical Yearbook" and "China Environmental Statistical Yearbook", which is operated on StataSE15.

3. Results and Discussion

3.1. The Direct Effect Mechanism Test of the Impact of Natural Capital Investment on Economic Growth

After passing the unit root test and cointegration test, the fixed effects model was selected. First, we examine the direct effect mechanism of natural capital investment on economic growth. The results are shown in Table 1. The data in the first column does not consider the impact of physical capital, human capital, openness, and urbanization rate on economic growth. In addition to the investment in ecological restoration and governance, forestry investment, environmental pollution control investment, urban infrastructure construction investment and forest coverage rate have all contributed to economic growth, and the statistics are significant at the 1% level. This may be due to insufficient investment in ecological restoration and governance. At present, the main source of investment in ecological restoration and governance is national financial funds, and the participation of social capital and multiple market players is not high. The natural capital stock represented by forest coverage can effectively promote economic growth, further demonstrating the importance of investing in natural capital to enhance the natural capital stock (Cai, 2008; Liu, 2018).

The second column of data adds the interaction term between forestry investment and forest coverage. Generally speaking, reasonable forestry investment can promote the improvement of the stock and quality of natural forest capital, and thus have a positive effect on economic growth. However, the empirical results are not so. Its interaction term has a significant hindering effect on economic growth, which is largely due to the lagging nature of forestry investment. Compared with economic growth, the growth of forest coverage is a

relatively slow process and requires long-term investment to achieve compensation for ecological benefits (Zhu, 2006).

The data in the third and fourth columns add fixed asset investment and human capital to the regression analysis, the effect of industrial pollution control investment on economic growth is no longer significant, and the regression coefficient of natural capital stock represented by forest coverage has dropped from 0.05 to 0.019, which indicates that fixed asset investment and human capital may have an inhibitory effect on it, which is in line with the assumption that the intervention of physical capital makes the inhibitory effect of natural capital on economic growth more obvious (Xue et al., 2016). At the same time, it also shows that fixed asset investment has a strong impetus to economic growth, and it is reasonable and scientific to use it as a control variable.

The fourth column adds all control variables to the regression equation. The absolute value of the natural capital investment coefficient is decreasing, but the forestry investment, urban environmental infrastructure construction investment, and industrial pollution control investment are at the level of 5%, 1%, and 10%, respectively. significantly. This is basically in line with hypothesis 1: natural capital investment has a direct role in promoting economic growth. Among them, forestry investment has a greater role in promoting. In 2019, there are 9 provinces with a total output value of forestry industry exceeding 400 billion yuan (The data comes from China Zhiyan Consulting (2021, February 2)). The development potential of the forestry industry is huge, and its ability to radiate the economy is also enhanced. The investment in ecological restoration and governance is still not significant, and the lack of investment funds due to the lack of market entities may be the reason for its insignificant economic growth benefits. The regression coefficient of industrial pollution investment is only significant at the 10% level, partly because the coverage of investment data is not accurate enough. On the other hand, it also shows that through investment in other natural capital, through technological innovation and progress, the production method should be transformed as soon as possible, and the production of industrial pollution should be reduced or even avoided. The coefficients of environmental infrastructure investment and other control variables are significant at the 1% confidence level. In the context of the urbanization process, accelerating investment in urban environmental infrastructure construction can not only prevent the economy from hindering the economy due to infrastructure, but also use its technological first-mover advantage to promote economic development in turn. Therefore, it is necessary to strengthen the management of investment in urban environmental infrastructure, and use innovative means to ensure economic benefits and investment efficiency (Niu & Zhao, 2010). In general, natural capital investment can directly create ecosystem products and services, influence and guide the construction and development of industries related to ecosystem products and services, reduce the cost of ecological environment governance, improve the investment structure, and play an important role in economic growth. positive push.

Finally, in order to consider the difference in the impact of direct and indirect natural capital investment on economic growth, in the sixth column, the interactive items of forestry investment and ecological restoration and governance investment, and the interactive items of industrial pollution control investment and urban environmental infrastructure

construction investment are respectively set. Both results are significant at the 1% level, which can tell us that there is a mutual promotion between natural capital investment, which is consistent with the supply and demand effects of natural capital investment. Through investment in natural capital, it can influence, guide and drive the development of many related industries, thereby strengthening the driving role of economic growth. This also suggests that we should strengthen natural capital investment in all aspects and play a positive role in promoting various types of natural capital investment.

Table 1. The direct contribution of natural capital investment to economic growth

VARIABLES	lnGDP	lnGDP	lnGDP	lnGDP	lnGDP	lnGDP
lnFI	0.228***	0.276***	0.071**	0.074**	0.059**	
	(4.76)	(5.45)	(1.97)	(2.27)	(2.00)	
lnEI	0.061	0.059	0.041	-0.001	-0.004	
	(1.30)	(1.27)	(1.18)	(-0.02)	(-0.13)	
lnCI	0.201***	0.200***	0.048***	0.043***	0.048***	
	(11.55)	(11.59)	(3.18)	(3.13)	(3.92)	
lnWI_Mg	0.047***	0.045***	0.007	0.014	0.017*	
	(3.13)	(3.05)	(0.61)	(1.41)	(1.92)	
Forestcover	0.028***	0.050***	0.019***	0.013***	0.009***	0.009***
	(12.56)	(6.14)	(10.94)	(7.47)	(5.08)	(5.23)
lnK			0.431***	0.375***	0.326***	0.353***
			(18.85)	(17.53)	(15.24)	(17.39)
L				0.245***	0.163***	0.169***
				(9.93)	(6.56)	(6.80)
urban					0.013***	0.013***
					(5.65)	(5.41)
Jh=lnFI*forestcover		-0.002***				
		(-2.74)				
Z1=lnFI*lnEI						0.002***
						(3.22)
Z2=lnCI*lnWI_Mg						0.002***
						(3.45)
Constant	10.701***	10.088***	8.001***	7.567***	8.829***	9.254***
	(48.81)	(32.32)	(37.12)	(38.07)	(36.42)	(34.18)
Observations	450	450	450	450	450	450
R-squared	0.899	0.901	0.946	0.956	0.965	0.964
Number of code	30	30	30	30	30	30
district FE	YES	YES	YES	YES	YES	YES
F test	0	0	0	0	0	0
r2_a	0.891	0.893	0.941	0.952	0.962	0.961
F	742.3	629.5	1,206	1,291	1,257	1,573

Note: t-statistics in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

3.2. The Indirect Effect Mechanism Test of the Impact of Natural Capital Investment on Economic Growth

Before discussing the indirect effect mechanism of natural capital investment on economic growth, first familiarize yourself with a new concept, the mediating effect. The mediating effect, as the name implies, means that the explanatory variable X has an impact on the explained variable Y, the explanatory variable X has an impact on the mediating

variable Z, and finally the explanatory variable X has an impact on the explained variable Y through the mediating variable Z, that is, there is a mediating effect, and the transmission model is shown in Figure 1.
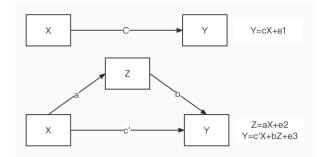

Figure 1. Mediation transfer model

From the previous empirical regression analysis results, it can be seen that natural capital investment has a significant impact on economic growth. It is now possible to consider whether human capital accumulation is a potential channel for influencing economic growth. Human capital is set as the mediating variable, the explained variable is lnGDP, and the explanatory variable is natural capital investment. Hypothesis 2 points out that investment in natural capital can promote the accumulation of human capital, and the improvement of human capital can promote economic growth, so natural capital investment can indirectly lead to economic growth through the channel of human capital. In addition to the significant impact of natural capital investment on economic growth, natural capital investment also has a significant role in promoting human capital accumulation, and ultimately achieves that investment promotes economic growth through the intermediary variable human capital. Before this empirical analysis, three fixed-effect models need to be used, which are simply expressed as:

Model 1: Economic growth$_{it}$ = α_0 + α_1 Natural capital investment$_{it}$ + α_2 Control variable$_{it}$ + e$_{it}$

Model 2: Human capital$_{it}$ = α_0 + α_1 Natural capital investment$_{it}$ + α_2 Control variable$_{it}$ + e$_{it}$

Model 3: economic growth$_{it}$ = α_0 + α_1 natural capital investment$_{it}$ + α_2 human capital + α_3 control variable$_{it}$ + e$_{it}$

Because both direct and indirect natural capital investment will have a certain impact on human capital accumulation, the interaction term of direct natural capital investment and indirect natural capital investment is set, and the regression results are shown in Table 2.

The results in the first column show that natural capital investment has a positive effect on economic growth. The coefficient of natural capital investment is significant at the level of 1%. The greater the investment, the more obvious the promotion effect on economic growth. The results in the second column show that natural capital investment also has a positive effect on human capital accumulation, and its coefficient is still significant at the 1% level. Increasing natural capital investment will accelerate human capital accumulation and produce spillovers. The results in the third column are significantly positive. Both natural capital investment and human capital accumulation are significant at the 1% level, which fully proves that natural capital investment can indirectly affect economic growth through the realization of human capital accumulation.

Table 2. The indirect contribution of natural capital investment to economic growth

VARIABLES	lnGDP	L	lnGDP
Z	0.011***	0.010***	0.008***
	(13.93)	(9.28)	(9.78)
L			0.366***
			(11.51)
lnK	0.206***	0.104***	0.168***
	(11.61)	(4.36)	(10.62)
Forestcover	0.028***	0.030***	0.017***
	(12.02)	(9.56)	(7.60)
Constant	12.442***	4.745***	10.706***
	(56.80)	(16.11)	(43.99)
Observations	450	450	450
R-squared	0.896	0.768	0.921
Number of code	30	30	30
district FE	YES	YES	YES
F test	0	0	0
r2_a	0.887	0.750	0.914
F	892.2	344.9	965.8

Note: t-statistics in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Human capital is an important factor affecting economic growth. Most researchers believe that the improvement of natural capital can effectively improve the ecological environment, improve the quality of the ecological environment, and then improve the production and living environment of human beings, improve the health level of the people, and then promote the increase of healthy human capital (Fogel, 2004; Wang, 2012; Xu, 2014). When people have good physical health, it will prolong people's labor time, improve labor efficiency, and get more remuneration. When people are in a pleasant environment, it can further stimulate their enthusiasm for work and life, and not only improve the ecology The sense of gain and happiness can stimulate consumer demand and promote economic growth. Having healthy human capital will also directly or indirectly increase investment in educational human capital. Whether people have good health status will directly affect the national education opportunities, efficiency, education level and labor supply. At this level, it will also affect economic growth.

3.3. Regional Differences in the Impact of Natural Capital Investment on Economic Growth

To explore regional differences in the impact of natural capital investment on economic growth, China is divided into eastern, central, western, and northeastern regions. Table 3 shows empirical results on the impact of natural capital investment on economic growth by region. Z1 represents the interaction item of forestry investment and ecological restoration and governance investment, which means direct natural capital investment. Z2 represents the interaction term of environmental pollution control investment and urban infrastructure construction investment, which represents indirect natural capital investment.

The first column of data is the empirical result of the eastern region. The direct natural capital investment coefficient is significant at the level of 1%, and the indirect natural capital investment effect is not obvious. The data in the second column is the empirical result of

Table 3. Regional differences in the impact of natural capital investment on economic growth

VARIABLES	Eastern region	Central region	Western region	Northeastern region
Z1	0.003***	0.004***	0.001	0.004
	(2.87)	(3.09)	(0.99)	(1.55)
Z2	-0.001	0.003**	0.002***	0.006***
	(-0.63)	(2.58)	(2.76)	(2.79)
Forestcover	-0.005	0.009**	0.010***	0.060***
	(-1.41)	(2.33)	(4.15)	(4.89)
lnK	0.446***	0.291***	0.373***	0.352***
	(8.65)	(7.66)	(11.60)	(4.66)
L	0.159***	0.123***	0.098***	0.085
	(3.48)	(2.76)	(2.79)	(0.58)
urban	0.007	0.012**	0.018***	-0.017
	(1.35)	(2.31)	(5.18)	(-1.14)
Constant	9.070***	10.352***	8.925***	8.590***
	(13.90)	(16.67)	(22.83)	(8.20)
Observations	150	90	165	45
R-squared	0.962	0.980	0.979	0.943
Number of code	10	6	11	3
district FE	YES	YES	YES	YES

Note: t-statistics in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

the central region. The direct natural capital investment coefficient and the indirect natural capital investment coefficient are significant at the level of 1% and 5%, respectively. The third column and the fourth column are the empirical results of the western region and the northeastern region, respectively. The indirect natural capital investment coefficient of the two is significant at the level of 1%, and the direct natural capital investment effect is not obvious. Fixed asset investment is significant at the 1% level in the eastern, central, western and northeastern regions, showing the strong influence of fixed asset investment on economic growth. The coefficient of human capital in the eastern and central regions is significantly larger than that in the western region, and the human capital in the northeastern region has no significant impact on economic growth, which is also in line with the law of my country's economic development.

As far as the natural capital stock represented by the forest coverage rate is concerned, the natural capital stock in the central, western and northeastern regions has a more significant role in promoting economic growth, and the northeastern region is the strongest, the western region is the second, the central region is the smallest, and the eastern region is not. Significantly. This is related to the abundance of forests in the northeastern and western regions. However, it is precisely because of the relatively abundant natural capital that the northeastern and western regions lack investment in direct natural capital, the corresponding natural capital industry cannot develop rapidly, the foundation of the forestry industry is weak, and the benefits of forest resource development and utilization are not high. There is still a big gap between the output value per unit area and developed provinces, and ecosystem products and services are in urgent need of improvement. Compared with the central, western and northeastern regions, the

eastern region has less forest resources, and the stock of natural capital is limited. The investment in environmental pollution control and environmental infrastructure construction has no significant impact on economic growth. The increase of related industries and products has a greater impact, and it also reminds that the economic growth mode of the eastern region also needs to be transformed. It should not be at the expense of environmental pollution and ecological damage, but should move towards green development.

4. Conclusions

First, natural capital investment can be divided into direct investment and indirect investment. The former directly leads to an increase in the quantity and quality of natural capital and improves ecological stability and resilience (including forestry investment, ecological restoration and governance investment, etc.). Indirect investment can slow down the rapid consumption of natural capital and reduce the negative externalities of environmental pollution (including investment in renewable energy, investment in urban environmental infrastructure construction, and investment in environmental pollution control, etc.).

Second, construct the mechanism by which natural capital investment affects economic growth. The direct effect mechanism of the impact of natural capital investment on economic growth: natural capital investment will promote the formation and development of industries, products and services, and it will have economic benefits and directly create GDP. The indirect effect mechanism of the impact of natural capital investment on economic growth: natural capital investment will promote the accumulation of human capital, and human capital can effectively promote economic growth, which is an indirect driving effect.

Thirdly, to establish an extended C-D production function, a fixed-effect model is used for empirical analysis, and the results show that natural capital investment has a significant role in promoting economic growth. The coefficients of the mediation effect are significantly positive, indicating that natural capital investment will also indirectly promote economic growth through the channel of human capital. The empirical results are consistent with theoretical research.

In order to achieve sustainable economic growth, it is necessary to deeply understand natural capital investment and establish a correct concept of natural capital investment; increase natural capital investment channels, establish and improve natural capital allocation mechanism; increase natural capital investment, and focus on promoting talents to boost industrial development; Only in the end can increase the stock of natural capital, improve the quality of natural capital, increase the quality of ecosystem products and services, promote the establishment and development of related natural capital industries, and then promote the optimization and upgrading of investment structure and industrial structure, and inject new impetus into long-term economic growth.

Conflict of interest: none

References

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J.A. (2016). *Democracy does cause growth* (Working Papers Series). Boston University - Department of Economics - The Institute for Economic Development.

Bi, X. (2004). Research on the Intergenerational Allocation of Natural Capital – Design of Property Rights System for Sustainable Development. *China Industrial Economics, 8*, 20–25. https://doi.org/10.19581/j.cnki.ciejournal.2004.08.003

Bo, P. (2021, June 8). *The results of national soil and water loss dynamic monitoring in 2020 show that my country's ecological environment continues to improve*. Central government portal. http://www.gov.cn/xinwen/2021-06/08/content_5616233.htm (in Chinese)

Cai, Z., & Liu, W. (2008). The Natural Capital Investment Model from the Perspective of Sustainable Development. In *Harmonious Development and Systems Engineering: Proceedings of the 15th Annual Conference of the Chinese Society of Systems Engineering* (pp. 14–20). Chinese Society of Systems Engineering.

China Zhiyan Consulting. (2021, February 2). *2021-2027 China Forestry Construction Market Analysis and Investment Prospect Forecast Report*. https://www.sohu.com/a/448235726_120991686

Fogel, R. W. (1994). Economic Growth, Population Theory, and Physiology: The Bearing of Long-Term Processes on the Making of Economic Policy. *American Economic Review, 84*, 369–395.

Hu, A., & Wang, Y. (2005). Analysis Framework of China's National Conditions: Five Capitals and Dynamic Changes (1980-2003). *Management World, 11*, 4–11+171. https://doi.org/10.19744/j.cnki.11-1235/f .2005.11.002

Liu, S. (2014). Analysis of the spillover effect of human capital. *Economic Science, 2*, 79–90. https://doi.org/10.19523/j.jjkx.2014.02.007

Liu, Y., Liang, S., & Zhang, L. (2018). Ecological Capital Accumulation, Innovation and Regional Economic Growth. *Resource Development and Market, 3*, 347–354.

Ma, Z., & Tian, S. (2017). The Impact of Key Natural Capital on China's Regional Economic Growth. *Ecological Economy, 7*, 78–81.

Niu, T., & Zhao, S. (2010). An empirical study on the relationship between investment in urban environmental infrastructure construction and economic growth in China. *Urban Development Research, 6*, 128–131.

Pan, S. (2019). *Research on the Investment Effect of Agricultural Ecological Capital*. Zhongnan University of Economics and Law. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2020&filename=1019862404.nh

Qi, Y., Lu, H., & Zhang, N. (2015). Environmental Quality, Healthy Human Capital and Economic Growth. *Finance and Trade Economics, 6*, 124–135. https://doi.org/10.19795/j.cnki.cn11-1166/f.2015.06.011

Shi, S., & Liu, H. (2004). Economic Growth Model of Human Capital, Ecological Capital and Technological Progress. *Financial Science, 5*, 62–66.

Stern, N., Xie, C., & Zenghelis, D. (2020). *Promoting Strong, Sustainable Inclusive Growth in China in the New Era - Report 2: The 14th Five-Year Plan should focus on and invest in physical capital, human capital, natural capital and social capital*. London: Grantham Institute for Climate Change and Environment, London School of Economics. https://www.docin.com/p-2379999290.html.

Tu Zhifang, L. M., Sun Tao. (2016). The Status and Trend Analysis of Desertification and Sandification. *Forest Resources Management, 1*(1), 1–13. https://doi.org/10.13466/j.cnki.lyzygl.2016.01.001 (in Chinese)

Xinhua News Agency (2022, March 3). *Speech by Xi Jinping at the General Debate of the 75th United Nations General Assembly (full text)*. Chinese People's Political Consultative Conference. http://www.rmzxb.com.cn/c/2022-03-03/3062746.shtml (in Chinese)

Xue, Y., Zhang, Z., & Wang, J. (2016). Research on the Relationship between Natural Capital and Economic Growth: From the Perspective of Capital Accumulation and Institutional Constraints. *Journal of Soochow University (Philosophy and Social Sciences Edition), 5*, 102–111. https://doi.org/10.19563/j.cnki.sdzs.2016.05.012

Yan, C. (2012). Social capital, innovation and long-term economic growth. *Economic Research, 11*, 48–60.

Yang, M. (2017). *A study on the spatial and temporal patterns of natural capital utilization in the Yangtze River Delta urban agglomeration since 2000*. Nanjing Normal University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname= CMFD201801&filename=1017278703.nh

Yang, F., Yan, C., & Xiong Y. (2016). Government Investment, Human Capital Improvement and Industrial Structure Upgrade – An Empirical Analysis Based on Panel VAR Model. *Exploration of Economic Issues, 12*, 18–25.

Yu, S., Lv S., & Ran, S. (2020). Analysis of the Impact of Natural Capital Investment on the "Double Growth" of GDP and Natural Capital – An Empirical Study Based on Chongqing. *Qinghai Social Sciences*, *3*, 132–138. https://doi.org/10.14154/j.cnki.qss.2020.03.019

Xu, Z., & Tan, Y. (2014). Healthy Human Capital, Educational Human Capital and Economic Growth. *Journal of Guizhou University of Finance and Economics, 6*, 21–28.

Zhao, J. (2009). *Research on the Effect of China's Fixed Asset Investment on Economic Growth*. Northwest A&F University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD2011&filename= 2010049668.nh

Zhao, Z. (2012). *Research on Regional Economic Growth Supported by Ecological Capital*. Ocean University of China. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201301&filename=1012505287.nh

Wang, D., Gong, L., & Li, H. (2008). Healthy Human Capital, Healthy Investment and Economic Growth: A Case Study of China's Cross-Provincial Data. *Management World, 3,* 27–39. https://doi.org/10.19744/j.cnki.11-1235/f.2008.03.004

Zhu, H. (2007). Analysis of long-term and short-term investment in forestry based on the concept of natural capital investment. *Forestry Economic Issues*, 2, 112–116. https://doi.org/10.16832/j.cnki.1005-9709.2007.02.004