Pisco Med Publishing

Environment Regulation and Green Total Factor Productivity: A Case Study in the Yellow River Basin

Xinzhe Qi
Northwest normal university, Lanzhong 730070, China.

Abstract: From the perspective of the dual effects of cost and technological innovation, the impacts of two types of environmental regulations and their synergistic effects on green total factor productivity are analyzed. Research shows that: the command type, market-oriented green total factor productivity improvements of the basin show a positive role in promoting, at the same time, market-oriented regulation strength instead of their own technological innovation ability in the work together in the valley of green in the process of the total factor productivity improvements, cooperate efforts to achieve better coordination between them, realize the coordinated development.

Keyword: Environment Regulation; GTFP; Yellow River Basin

1. Introduction

The winding Yellow River, flowing for thousands of years, feeds the Chinese civilization. The Yellow River basin covers nine provinces and autonomous regions, with more than 400 million permanent residents, accounting for about 30 percent of China's total population. The Yellow River basin is an important part of the national ecological barrier. Through the loess plateau soil and water loss area, five desert sandy land, estuary delta and other areas. The diversity of ecological types makes it difficult for a single environmental regulation policy to work.

Due to historical and natural conditions, the Yellow River has always been "weak and sickly", with poor ecological foundation, very short of water resources, serious soil erosion and weak carrying capacity of resources and environment. Unbalanced and inadequate development among provinces and regions along the Yellow River is a particularly prominent problem. The basin, which accounts for only 25% of the country's GDP, is divided into five contiguous areas of extreme poverty. Development is the hard principle, water resource constraint is the soft principle. The water resources of the Yellow River have become the rigid constraint of urban development in the Yellow River basin and the inevitable requirement of promoting the high-quality development of urban agglomeration in the Yellow River Basin. The shortage of water resources is the biggest contradiction in the Yellow River basin. Low efficiency of water use, lack of integrated water resource allocation, unclear water right allocation, and lack of accountability measures. Ecological protection and high-quality development of the Yellow River basin have become major national strategies. To solve the "good" problem of watershed water conservancy security has become a new topic of the Times.

Under the condition of water resource restriction, the mechanism of influencing green total factors is investigated from the perspective of environmental regulation. At the same time, explore the impact of different types of environmental regulation on total factor productivity (GREEN). In addition, it introduces green total factor productivity and draws a conclusion on policy based on the influence mechanism of environmental regulation on green total factor productivity.

2. Literature review

The impact mechanism of environmental regulation on green total factor productivity can be divided into two categories: "cost theory" and "Porter effect". From the perspective of "cost compliance theory", Simoes et al. took Portugal from 2001 to 2008 as the research object and proved that regulatory environmental regulation policies had no significant effect on GTFP.[2]Yin Baoqing (2012) took the manufacturing industry as the research object and concluded that there was an inverted U-shaped relationship between environmental regulation and GTFP.[6]

The influencing mechanism of "Porter hypothesis" can be summarized as follows: it is considered that the innovation compensation effect generated by stimulating the improvement of enterprises' innovation r&d ability (Porter, 1991).[1] Zhao Hong (2007) Environmental regulation can promote technological innovation.[7]

However, when studying environmental regulation, many scholars do not subdivide the policy of environmental regulation. However, depending on the indicators chosen, the conclusions can be different. He Xingbang (2020) believes that market-based environmental regulation policies make command-based environmental regulation better.[3] Yang Yun (2017) believes that fine-tuning command-type environmental regulation policies can be better regulated.[5] At the same time, some scholars put forward that the improvement of GTFP also needs collaborative governance. Guo Han and Ren Baoping (2020) put forward that the green and high-quality development of watershed is faced with many constraints, such as rigid resource constraints, backward infrastructure and weak industrial association.[4] In order to achieve high-quality development of watershed, coordination and systematic governance must be carried out to optimize the watershed division system and spatial governance system.

3. Green total factor productivity and its influence mechanism

3.1 Green total factor productivity

Traditional TFP takes into account only the growth rate of expected output minus the contribution of all inputs to economic development. True TFP should be subtracted from "undesired contributions". So real TFP is lower than traditional TFP. That is, when we use total factor productivity as a measure of economic development, we generally overestimate the performance of the economy. In order to avoid the deviation of traditional total factor productivity in measuring economic growth, we use total factor productivity to consider unexpected output. The new total factor productivity (TFP) is also called green total factor productivity (GTFP) because most of the undesired outputs are pollutants. This indicator balances desired and undesired outputs and correctly evaluates changes in economic performance and social welfare levels. Thus, appropriate and appropriate policy recommendations can be obtained.Construct a production possibility set that contains both desired and undesired outputs. Integrate production possibilities into environmental technologies. It is assumed that N inputs $x = (x_1,...,x_n) \in R_N^+$。 . M kinds of expected outputs $y = (y_1,...,y_n) \in R_M^+$, and I non-expected outputs $b = (b_1,...,b_n) \in R_I^+$, P(x) is used to represent the production possibility set (environmental technology). That is, the possible frontier of output that considers environmental factors.

Directivity distance function is used to calculate productivity under environmental regulation. $g = (g_y + g_b)$ is the direction vector of output expansion. Under the assumption of weak disposability, the expected output should be increased while the undesired output should be reduced. Then the direction vector is $g = (y, -b)$。

Substitute the directional distance function to obtain the productivity index between t period and T +1 period.

The ML index can also be divided into two parts: efficiency Change Index (EFFCH) and Technology progress Index (TECH).

$$\mathrm{ML} = \mathrm{EFFCH} \times \mathrm{TECH}$$

$$EFFCH_t^{t+1} = \frac{1 + \overrightarrow{D_0^t}(x^t, y^t, b^t; g^t)}{1 + \overrightarrow{D_0^{t+1}}(x^{t+1}, y^{t+1}, b^{t+1}; g^{t+1})}$$

$$TECH_t^{t+1} = \left\{ \frac{1 + \overrightarrow{D_0^{t+1}}(x^t, y^t, b^t; g^t)}{1 + \overrightarrow{D_0^t}(x^t, y^t, b^t; g^t)} \times \frac{1 + \overrightarrow{D_0^{t+1}}(x^{t+1}, y^{t+1}, b^{t+1}; g^{t+1})}{1 + \overrightarrow{D_0^t}(x^{t+1}, y^{t+1}, b^{t+1}; g^{t+1})} \right\}^{\frac{1}{2}}$$

3.2 Influence mechanism

There are two main perspectives. The impact of command-based environmental regulation on green total factor productivity can be divided into cost effect and innovation compensation effect of Porter's hypothesis. Similarly, the impact of market-based environmental regulation on green total factor productivity can be divided into cost effect and innovation compensation effect of Porter's hypothesis. At the same time, there is a synergistic effect between market-based environmental regulation and command-based environmental regulation, which has a positive impact on green total factor

productivity. In general, the simultaneous implementation of a transaction can be more successful in improving green total factor productivity. The implementation of command-based environmental regulation and market-based environmental regulation correspond to each other and jointly promote the improvement of green total factors.

From a cost perspective, command-based and market-based environmental regulations can cannibalize corporate capital, as companies invest in environmental aspects that are not part of the corporate budget, reducing capital investment in innovation and production. Thus, the promotion of green total factor productivity has a restraining effect.

In terms of Porter hypothesis, environmental regulation policies adapted to the market are ordered. Through the research and development of environmental protection technology, enterprises can gain a dominant market position, so as to promote the improvement of green total factor productivity. Its innovative products also increase the core competitiveness of products in the market and improve the profits of enterprises. At the same time, the increase of innovation has reduced the negative externalities of polluting enterprises' production and brought lasting development impetus to local and enterprises themselves.

4. Policy suggestions

4.1 Improve the technological innovation capacity of enterprises

On the one hand, we should increase investment in environmental protection facilities and equipment. At the same time, we will strengthen innovation in government management systems, actively carry out environmental protection and transformation of production modes, and realize the transformation of production in high-polluting energy enterprises. Thus saving the cost of environmental governance, to avoid governance, but did not improve the environment of the cycle.

4.2 Implementing differentiated governance policies

The development of the Yellow River basin should not only focus on ecological construction and environmental protection, but also pay attention to the high-quality development foundation of the basin. Because there are large areas of grain production and energy exploitation in the Yellow River basin, it is necessary to develop its own development characteristics by consolidating food and energy security; of course, improve the rapid development of the whole basin, both to ensure that the original production of high quality and strong environmental protection, and to cultivate new economic growth pole, improve basin's high-quality development power, such as through the construction of large data center, for the basin economy and less developed areas of old and new kinetic energy conversion path, the development of the national economy quality.

References

[1] Porter ME. America’s Green Strategy[J]. Scientific American, 1991:193-246.

[2] Simoes, P, Rui, CM. Influence of regulation on the productivity of waste utilities. What can we learn with the Portuguese experience? [J]. Waste Management, 2012, 32(6)：1266-1275

[3] He, XB. Heterogeneous environmental regulation and the quality of China's economic growth: Is administrative order better than market means? [J]. Journal of business research, 2020 (9) : 82-91.

[4] Guo, H, Ren, BP. Spatial governance of high-quality development in the Yellow River Basin: mechanism interpretation and realistic strategies [J]. Reform,2020(04):74-85.

[5] Yang, Y. Fine-tuning rationality and reality questioning of command-and-control environmental regulation [J]. Journal of southeast university (philosophy and social science edition), 2017, 19(S1):100-104.

[6] Yin, BQ. Environmental regulation and green total factor productivity in China's manufacturing industry: An empirical study based on the perspective of international vertical specialization. China population, resources and environment, 2012, 22(12):60-66.

[7] Zhao, H. The impact of environmental regulation on Industrial technological innovation in China [J]. Economic Management, 2007(21):57-61.