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The influence of Chinese environmental regulation on corporation innovation and competitiveness

Xin Zhao [a, *], Bowen Sun [b, 1]

[a] Wuhan University, Economics and Management School, China
[b] Wuhan University, Institute for the Development of Central China, China

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ABSTRACT

According to Porter hypothesis, appropriate environmental regulation can promote corporation innovation. The innovation will even offset the corporation loss caused by environmental regulation and improve corporation competitiveness. In order to explore the porter hypothesis practical situation in China, this paper does an empirical study to explore this mechanism by using Chinese pollution-intensive corporations panel data samples during 2007–2012. Results show that the implementation of flexible control policies has achieved initial success. Environmental regulation has significant positive effects on corporation's innovation, but the fact of its weak effects also partly explains why environmental regulation still has negative effects on corporation competitiveness even it is insignificant. From the point of regional differences, east and middle regions have weak but not strong porter hypothesis phenomenon while that of the west region is not significant. Return on Assets (ROA) and Gross Domestic Product (GDP) in the east region are relatively higher which is not based on high energy consumption and environmental pollution, but due to the high transformation rate of Research and Development Expenditure (R&D) to ROA. For the middle region, even it shows signs of the strong Porter Hypothesis, but due to the fact that government gives fiscal subsidies and tax returns to companies to cover the cost from environmental regulation, it only has the weak but not strong porter hypothesis phenomenon since this mechanism is not consistent with that of Porter Hypothesis.

1. Introduction

China is in the process of economical construction transformation. The growth rate of Gross Domestic Product (GDP) has slowed down from 10% to 8% in recently years. Maybe the Chinese government has already realized the high increase of economic development relies on the high cost of environment energy like coal, gas and the related environmental pollution (Guohui and Yunfeng, 2012; Li et al., 2014). From the year 1978–2011, the total amount of Chinese energy consumption endured an urgent increase from 571.44 million to 3480.02 million measured by standard coal (Li and Lin, 2015; Lin and Moubarak, 2014; Zheng et al., 2014). The increase rate was as high as 5.63% per year. However, at the same time, the GDP of China showed a sharp rise of 50.98% in just 5 years from 2006 (Holz, 2014). For other developed countries, the GDP may enjoy a much higher development with equivalent energy consumption. It indicates that the quick development of GDP was at the cost of energy. In the year 2011, GDP per energy consumption in China was 2.5 times of the world average level and 3.3 times of that in USA (Holz, 2014). As a result, Chinese government pays more attention to the environment pollution these years. Before the year 2007, the main method in pollution control was based on command-control policy such as setting pollutant emission standards, setting rectification deadline and closing such pollution-intensive companies (Zhao et al., 2015). But it proved to be ineffective. Such policy leaded to the result of high regulation cost, low control efficiency and low company profit (Wang et al., 2011). In that case, Chinese government changed it from such compulsory measures to market related policies. Such policies included the "Regulation Enforcement of Export Companies' Environmental Protection" in the year 2007, the "National Environmental Protection 'Twelfth Five-year' Plan" in 2011 and the new "Environment Quality Standard" (GB3095-2012) released in 2012 (Dong et al., 2015; Lui and Leamon, 2014) . After these new

* Corresponding author. Economics and Management School, Wuhan University, Wuhan, Hubei Province, 430072, China. Tel.: +86 18062767156.
E-mail addresses: zhaoxinforever@foxmail.com (X. Zhao), lansebowen@whu.edu.cn (B. Sun).
[1] Tel.: +86 18707138850.

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environmental policy series implemented, Chinese environmental governance has gained a stage achievement.

Environmental regulation has achieved great effect on the environmental pollution, then how can this be achieved? In most cases, Chinese government forced companies to pay for the environmental regulation cost since they gained most from environment pollution (Zhao et al., 2015; Zhu et al., 2014). But it is obvious that the corporation environmental expenditure significantly limits corporation behavior. On the contrary, the government environmental regulation can reduce the level of environmental pollution, while not aim to harm the corporation competitiveness (Yin et al., 2015). So, in these years, has the government achieved its two-edged aims? It remains to be seen. Specifically, the effects of environmental regulation on corporations include two main parts: strict environmental regulations can promote corporation environmental technology innovation, and help develop better environmentally friendly products or find ways to reduce pollution, then finally promote the corporation competitiveness (Bi et al., 2014; Minghua and Yongzhong, 2011); The extra spending from prevention and control of environmental pollution treatment, inevitably increases the cost of corporation, thus influences corporation competitive advantage (Zhao et al., 2015). The strictness of environmental regulation can lead to different effects on corporations. Environmental regulation could eventually drive the corporation innovation, and promote the improvement of corporation competitiveness, while reduce corporation competitiveness and cause negative results. So for Chinese corporations, what is the result? In order to explore the result, this paper analyzed the effects of environmental regulation on corporations in theory and practice.

The contributions of this paper include: (1) the results are more reliable since the experiments are based on the city level. Literature until now has not paid much attention to such micro aspect level. (2) The unite of company development and domestic environment situation makes it possible to explore how to accelerate the development of company not only from its own company aspect but also from the domestic regional aspect like the domestic environmental regulation, government policy and domestic pollution, etc. Under this circumstance, this paper used the Porter Hypothesis theory to explore the possible situation in China and proved it with experiments. (3) Even though an increasing number of literatures have done experiments with the Chinese data, they achieved many kinds of results despite reasons like the difference in data time range and samples. However seldom literatures continue to explore how the Porter Hypothesis theory behaves in different regions. Maybe it will be possible to explain why such result exists. In this paper, experiments were continued to be done on different regions, specifically the east, middle and west regions. So that the regional difference is clear and suggestions under such experiments are more valuable.

After this brief introduction, the remainder of this paper is structured as follows. Section 2 summaries the Porter Hypothesis theory and forward the two hypothesizes according to Chinese situation. Section 3 presents the panel regression model for the whole Chinese regions with the presentation of model building, variables selection and sample selection, etc. Section 4 provides the result of the panel regression model and explains it. Section 5 introduces the regional multivariable regression model and explains the result combined with the domestic GDP and domestic pollution level. Conclusions are presented in the final Section 6.

2. Porter hypothesis

The traditional view of Palmer, Simpson and Bradford is that environmental protection behavior will increase the additional cost of the corporation, and weaken its competitiveness. In the 1990s, many economists verified the traditional viewpoint, two of the most famous of whom are Michael Porter (1991) and Claas van der Linde (1995). Among them, the Porter hypothesis has far-reaching influence. This theory states that pollution is some kind of resource waste. If the corporations reuse the waste of resources, then it will lead to the improvement in corporation competitiveness. Strict but reasonable designed environment control rules (especially market-oriented tools, such as taxes or emissions trading quotas) can stimulate innovation behavior, and may offset some or all of the cost of environmental regulation.

One essential factor to achieve the aim stated in Porter hypothesis is decent environmental regulation policy. That is to say, according to the decent and strict level of environmental regulation, porter hypothesis can be subdivided into three different segments, namely, strong, weak and local hypothesis (André et al., 2009; Feichtinger et al., 2005; Ford et al., 2014). The corresponding mutual relationship of them is shown in Fig. 1. First of all, under some circumstances, proper environmental regulation can stimulate money devotion in innovation, but it is not clear whether the profit achieved from innovation behavior can offset the additional cost caused by environmental regulation or not. This segment is often regarded as weak Porter hypothesis (Costantini and Mazzanti, 2012; Doganay et al., 2014). Respectively, the strong Potter hypothesis describes that benefit achieved from the innovation behavior can offset any additional regulation cost, which means environmental regulation can enhance corporations' competitiveness. In addition, local potter hypothesis presents the theory that flexible regulation can bring greater motivation for corporation innovation compared with the rigid regulation (Desrochers and Haight, 2014).

The establishment of the Porter hypothesis is based on the flexible market-oriented environmental regulation policy, rather than rigid command-control control policy (Zhao et al., 2015). Specifically, there are three conditions to be satisfied if the environmental regulation can enhance innovation (Caputo, 2014; Taylor et al., 2015). These conditions are: (1) environmental regulation policies should bring the most suitable convenience, rather than industrial standards, to company innovation behavior. (2) Regulation policies should allow technology to improve continually, other than forcing companies using a certain advanced technology. (3) The regulation departments should release long term policy guidance to minimize uncertainty. If these conditions were tested in China before 2007, command - control policy would not bring the convenience to achieve this aim. Nevertheless, after 2007, the Chinese government begins to focus on market-originated environmental policies, such as collect resource tax, discharge fee (Lui and Leamon, 2014). These policies belong to flexible environmental regulation policies, which give corporations more freedom to find a technical solution to minimize regulation cost (Caputo, 2014). From this point of view, environmental regulation in China after 2007 may have positive effect on corporation innovation. Based on the above analysis, Hypothesis 1 is forwarded.

Hypothesis 1. *environmental regulation may have positive effect on corporation innovation based on optimized Chinese environmental regulation policies.*

The innovation caused by environmental regulation may lead to the improvement of corporation competitiveness. This phenomenon is called “compensation from innovation”. Porter further divided “compensation from innovation” into process compensation and products compensation. When environmental regulation improves the utilization rate of resources during the production process, it leads to the process compensation. When environmental regulation not only forces companies to reduce pollution,