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Do environmental regulations cause enterprises to exit from market? Quasi-natural experiments based on China's Cleaner Production Standards

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ABSTRACT

Taking the implementation of Cleaner Production Standards at the industry level in China as a quasi-natural experiment, the impact of these standards on enterprises' exit behavior was empirically analyzed by using the Difference-in-Differences method. Results suggested that the implementation of Cleaner Production Standards reduced the probability of enterprises exiting the market. A parallel trend test, Propensity Score Matching (PSM), and the exclusion of other policy factors were then used to verify the robustness of this finding. The impact mechanism test showed that implementation of the standards reduced the probability of enterprises exiting the market through improving total factor productivity and promoting enterprise product innovation. The heterogeneity test revealed that, on the one hand, the implementation of Cleaner Production Standards can reduce the probability of R&D intensive industries and medium-sized enterprises exiting the market, and protect innovative and moderately sized enterprises. On the other hand, the implementation of Cleaner Production Standards can increase the probability of state-owned enterprises and small-scale enterprises exiting the market and optimize the allocation of resources among enterprises. This paper has important implications for China's future approach to environmental policy formulation as well as the optimization of domestic enterprise structure.

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1. Introduction

Since the reform and opening up, China has made great progress in economic development and gradually grown into the world's second largest economy (Su et al., 2022a; Wang et al., 2019a). Since 1949, China's total economic output has increased 10-fold, while total resource consumption has increased more than 40-fold (Jin et al.,

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2019). This economic development model, which emphasizes quantity growth and extended growth (Kim et al., 2018; Škare et al., 2021), not only severely consumes China's natural resources, but also causes substantial pressure on China's ecological environment. In 2018, China's total carbon dioxide emissions reached 9.43 billion tons, accounting for 27.6% of the total global carbon emissions (BP, 2019). In addition, among the 471 cities in China that measured precipitation in 2018, 37.6% of those cities experienced acid rain (BCEE, 2018). Coordinating the relationship between economic development and environmental protection remains the primary problem for the Chinese government and enterprises.

To deal with the problem of environmental pollution, the Chinese government has adopted various types of environmental policies (Chang & Fang,2023; Liao & Shi, 2018) to enhance the intensity of environmental regulation. The report of the 19th National Congress of the Communist Party of China also pointed out that the basic national policy of resource conservation and environmental protection should be adhered to, and the most stringent environmental protection system should be implemented. However, while improving the domestic environment, China's environmental regulations will increase the production costs faced by enterprises and weaken their competitiveness (Gray & Shadbegian, 2003), at least in the short term. In this case, environmental regulation seems to increase the probability of enterprises exiting from the market. This traditional way of thinking will undoubtedly bring great trouble to local governments that have long adhered to 'paternalism'. So, will environmental regulation really increase the probability of Chinese companies exiting the market? What is the micro mechanism of environmental regulation which determines whether enterprises exit from market?

In general, the formulation of effective environmental policies to enhance environmental regulatory strength depends on the study of existing environmental policies. At present, the impact of environmental regulation on the behavior of enterprises has not been determined (Cohen & Tubb, 2018). One point of view is that environmental regulation will force enterprises to use cleaner energy, increase pollution control equipment, and upgrade or transform production lines that do not meet environmental standards. This would increase enterprises' production costs, thus exerting negative effects on their economic activities, especially on their productivity (Boyd & McClelland, 1999; Gray & Shadbegian, 2001; Greenstone et al., 2012) and corporate profitability (Greenstone, 2002; Rassier & Earnhart, 2010). Another point of view is that appropriate environmental regulation can stimulate enterprises to carry out R&D and innovation, and the innovation compensation generated by technological improvement can offset or even exceed the external cost of environmental governance, namely the Porter hypothesis (Porter & Linde, 1995). In recent years, a large number of empirical studies have been carried out around this hypothesis, and the use of enterprise-level data has verified the long-term role of strict environmental regulations in promoting enterprise R&D and innovation (Hamamoto, 2006), improving enterprise productivity (Berman & Bui, 2001), and promoting regional economic growth (Jefferson et al., 2013).

Most of the above research on environmental regulation has only focused on changes in environmental regulation intensity, ignoring changes in governance conceptualizations in the process of improving environmental regulation intensity. In the past, environmental policies tended to take a 'pollution first, treatment later' approach, by reprocessing the generated pollutants to meet pollutant discharge standards (Pang et al., 2019). The disadvantage of this lies in that treatment of pollutants not only consumes a large amount of capital and increases production costs, but also in most cases, the pollutants cannot be completely eliminated, only diluted and transferred, leaving hidden dangers for future generations. Different from the environmental regulation policies of terminal treatment, the environmental protection strategy of front-end pollution control is another option (Manuel et al., 2007), which combines pollution control with the production process to fundamentally reduce the generation of pollutants. In China, the typical front-end pollution control policy is the Clean Production Standard implemented since 2003, which includes the energy used by enterprises, the production process, and the cleanness and greenness of the final products. The essence of cleaner production is to change the extensive growth mode at the expense of the environment and take an intensive growth path. This is not only conducive to environmental improvement, but also to innovation in enterprise production processes, improving production efficiency, and achieving a win-win situation between the environment and economic development. In view of this, this paper adopts micro-data at the enterprise level, takes the implementation of Cleaner Production Standards as the exogenous policy impact of the enhancement of environmental regulation intensity, studies the impact of environmental regulation enhancement on enterprises' market exit behaviors based on a Difference-in-Differences (DID) method, and discusses the micro-mechanism of its effect.

Results suggest that the implementation of Cleaner Production Standards can significantly reduce the probability of enterprises exiting the market. Endogeneity is addressed by means of a parallel trend test, Propensity Score Matching (PSM), and excluding the interference of other policy factors to ensure the robustness of the conclusion. In addition, this paper finds that the Cleaner Production Standards can influence enterprise exit behavior by improving total factor productivity (TFP) and promoting product innovation. On the one hand, the implementation of these standards puts forward higher requirements for equipment updating and process upgrading, and enterprises can take this opportunity to improve their production processes and innovation, leading to higher output efficiency (Manuel et al., 2007), stronger market competitiveness and survival ability, and reducing the probability that they will exit from the market. On the other hand, enterprises constrained by the Cleaner Production Standards will choose cleaner products with lower pollution levels. Through product innovation, enterprises can increase market share and reduce product demand elasticity (Zeng et al., 2010), further consolidate their market position, and reduce their market exit risk. Finally, the heterogeneity of the policy effect of the Cleaner Production Standards is evaluated. We find that for R&D intensive industries and medium-sized enterprises, the standards can reduce the probability of enterprise exit. For smaller, state-owned companies, the opposite is the case.

The contributions of this paper are as follows. Previous studies have tended to adopt the pollutant removal rate and pollution abatement expenditures as indicators of environmental regulation but often it is difficult to avoid endogeneity bias (Lu et al., 2012). Herein, the implementation of Cleaner Production Standards in China is taken as a quasi-natural experiment to improve environmental regulation intensity and the DID method is used to avoid endogeneity issues. The influence channels between Cleaner Production Policies and enterprises' withdrawal behaviors are discussed and the internal influence mechanism of environmental regulations on enterprises' exit behaviors is clarified, which can provide an empirical reference for policy makers and other stakeholders. The heterogeneity of enterprise exit behaviors in response to the standards is explored so as to avoid coarse conclusions. Research on different types of micro-enterprises can more accurately evaluate the implementation effect of environmental policies and provide a scientific basis for the formulation and implementation of environmental policies.

The rest of this paper is arranged as follows. In Section 2, the relevant literature is reviewed. Section 3 provides an institutional background and delineates the research hypotheses. Section 4 describes the econometric model, index construction, and data. Section 5 is devoted to the results and, finally, conclusions are offered in Section 6.

2. Literature review

Most studies on environmental regulation focus on the use of comprehensive environmental regulation indicators and investigate their impact on enterprises' TFP (Wang & Shen, 2016; Xie et al., 2017; Zhang et al., 2011) and their technological innovation (Jie & Bin, 2015; Rubashkina et al., 2015; Zhou et al., 2019). Zhang et al. (2011) evaluated China's TFP growth rate from 1989 to 2008 and the results showed that the implementation of environmental laws and regulations helped improve the productivity growth of China's manufacturing industry. Wang and Shen (2016) found that the relationship between environmental regulation and productivity in China is non-linear, with an inverted 'U' shape. Xie et al. (2017) investigated the impact of environmental regulations on industries with different pollution levels in China from the perspective of industry heterogeneity, and found that the formulation of environmental regulations should avoid uniform adoption of static standards and blind improvement of environmental regulation intensity. In terms of enterprise technological innovation, Rubashkina et al. (2015) used manufacturing data from 17 European countries between 1997 and 2009 and found that environmental regulation had a positive impact on the output of innovation activities. Jie and Bin (2015) revealed that environmental regulation not only increases the export volume of enterprises to developed countries, but also helps these enterprises to improve their technological level. Based on data from China's a-share listed companies between 2016 and 2018, Zhou et al. (2019) found that rigid environmental regulation has a negative effect on enterprise technological innovation, which can be alleviated by improving the flexibility of environmental regulation. In addition, to better solve the endogeneity problem and mitigate sample selection bias, some studies in recent years have used the DID method to investigate environmental policy, especially the Two Control Zones (TCZ) policy. Jefferson et al. (2013) found that this policy can stimulate dynamic market adjustment, making efficient enterprises enter and inefficient enterprises exit. Hering and Poncet (2014) further found that for highly polluting industries, the implementation of TCZ policies had a more significant impact. Cai et al. (2016) took the TCZ policy as a quasi-natural experiment, and found that environmental regulation inhibited the inflow of foreign capital. Through a heterogeneity analysis, they found that multinational companies from countries with high levels of environmental protection were not sensitive to increasingly stringent environmental regulation. Sun et al. (2019) investigated the impact of TCZ policies on employment in 287 cities from 1994 to 2009. The results showed that these policies did not promote an increase in total urban employment but increased the average wage of workers.

Another strand of research related to this paper pertains to enterprise exit. Jovanovic (1982) posited that the entry and exit of enterprises is the result of certain competition conditions. Only high-efficiency enterprises can enter the market and survive, while low-efficiency enterprises gradually shrink and eventually exit the market. Hopenhayn (1992) explained the reasons leading to the exit of enterprises from the perspective of productivity. By constructing a dynamic stochastic model of competitive industries, they searched for a critical productivity point determined by the equilibrium of industry entry and exit. When the productivity level of enterprises is lower than this critical point, enterprises will withdraw from the industry. At the same time, many scholars have analyzed the internal and external factors that affect enterprise exit. Audia and Greve (2006) used risk decision data of shipbuilding enterprises and found that the larger the enterprise scale and the better the resource endowment, the lower the risk of exiting the market, and the greater the ability to buffer against the threat of failure. Ferragina et al. (2012) analyzed the survival situation of enterprises with different ownership properties in Italy based on the Cox risk proportional model, and found that manufacturing and service enterprises of foreign multinational companies were more likely to exit the market than domestic enterprises. Further, Ferragina and Mazzotta (2015) used data pertaining to Italian enterprises between 2002 and 2010 to test the influence of the agglomeration economy on the exit of enterprises, and found that a diversified economy significantly increases the survival time of enterprises. Ejermo and Xiao (2014) studied the survival performance of Swedish new technology companies in the business cycle, and found that compared with other companies, the exit risk rate of these new technology companies was lower, which was a manifestation of their higher 'quality'. Mao and Sheng (2017) studied the impact of trade liberalization on enterprise dynamics in the context of substantial tariff reduction after China's accession to the WTO, and found that trade liberalization tended to reduce the likelihood of exit where enterprises had higher production efficiency.

It can be seen from the foregoing that some studies have explored environmental regulation and enterprise entry and exit, but these studies rarely explore the effects of implementing Cleaner Production Standard policy, and they often do not consider internal influence mechanisms or heterogeneity. In view of this, this paper uses the DID method to establish a model to systematically investigate the heterogenous impacts of implementing Cleaner Production Standards on enterprises' exit behavior, and seeks to clarify the main channels through which the implementation of these standards affects enterprises exit behavior.

3. Institutional background and research hypotheses

3.1. Institutional background

3.1.1. End treatment and cleaner production

Since the 1960s, the world economy has gone through a phase of rapid growth (Su et al., 2019a, 2022a). Due to the lack of adequate understanding of the environmental pollution caused by large-scale industrial production, many industrial pollutants are discharged into nature, and then diluted and degraded by nature. In the long run, the emission of pollutants exceeds nature's self-purification capacity, resulting in excessive environmental pollution and serious damage to the ecological environment. In more recent years, industry has had to shift from random emissions and diluted emissions to pollution control, which means developing effective treatment technologies for pollutants generated at the end of production. This practice is known as 'end treatment', which is the so-called 'pollution-first, treatment-later' model (Pang et al., 2019). Compared with the dilution of emissions, end treatment is a major step forward, not only helping to eliminate pollution events, but also to some extent reducing the pollution and damage to the environment caused by production activities. However, with the passage of time and the acceleration of industrialization, the limitations of terminal governance increase day by day. In practice, it is found that this method only focuses on the control of sewage with no incentive to discharge less than the permitted standard. Although it plays a certain role in a particular period or local area, it does not fundamentally solve the problem of industrial pollution.

Therefore, enterprises and governments of various countries began to explore ways to reduce the generation of pollution in the production process (Jackson, 2005). In April 1977, the European Commission formulated a policy on 'cleaner processes', and in 1984 and 1987 it formulated two regulations to promote the development of 'cleaner production'. In 1988, the Dutch Technology Evaluation Organization conducted a large-scale inventory study on the prevention of waste generation and emissions by Dutch companies, and formulated policies, technologies, and methods to prevent waste generation and emissions. The United States Congress passed the Pollution Prevention Act in October 1990, making pollution prevention a national policy.

The United Nations first proposed the concept of cleaner production in 1989 and further refined the definition in 1998. Cleaner production is defined by the United Nations as follows: cleaner production is a new and creative idea that continuously applies the environmental strategy of overall prevention to production processes, products, and services in order to increase ecological efficiency and reduce risks to people and the environment. For the production process, it is required to save raw materials and energy, eliminate toxic raw materials, reduce and reduce the quantity and toxicity of all wastes; for products, it is required to reduce the adverse effects of the whole life cycle from the extraction of raw materials to the final disposal of products; for services, environmental factors are required to be incorporated into the design and services provided. The development from terminal treatment to cleaner production does not mean that terminal treatment can be completely abandoned. It is compatible with and complementary to environmental improvement and pollution prevention and control (Manuel et al., 2007).

3.1.2. Cleaner production standards in China

The State Environmental Protection Administration of China (SEPA) began to institute industrial Cleaner Production Standards in 2001 with respect to 30 industries or products. In 2002, the Ninth National People's Congress Standing Committee passed the Clean Production Promotion Law, which clearly pointed out that the purpose of clean production is to reduce pollution at the source, improve the utilization of resources, and reduce or avoid the generation and discharge of pollutants in the process of production, services, and product use. On April 18, 2003, in the form of national environmental protection industry standards, Clean Production Standards for the petroleum refining industry, coking industry, and leather industry were officially promulgated, and they came into effect on June 1, 2003. By the end of December 2012, the Ministry of Environmental Protection had issued a total of 58 Cleaner Production Standards in 16 batches, including 56 Cleaner Production Standards for industries, 1 technical guideline for the formulation of guidelines, and 1 guideline for the formulation of standards. In the process of applying this kind of standard, the enterprise will compare the actual value of each small category index with the standard value of each level of standard, so as to judge the cleaner production level of each index of the enterprise.

The compilation and promulgation of Cleaner Production Standards aims to fulfill the responsibilities entrusted to environmental protection departments by the Clean Production Promotion Law, and to guide and promote the needs of enterprises for cleaner production from the perspective of environmental protection. It is an important means to accelerate the historic transformation of environmental protection work, raise the threshold of environmental access, and promote the optimization of environmental economic growth (Stjepanovic et al., 2022; Wang et al., 2022). Through publicity and promotion in recent years, the Cleaner Production Standards of SEPA have had a wide impact on the environmental protection system, industries, and enterprises throughout the country, and have become the basic standards in the field of cleaner production. Environmental protection departments at all levels have gradually taken these standards as the basis for environmental management, and as an important basis for cleaner production audits of key enterprises, environmental impact assessments, environmentally friendly enterprise assessments, and the construction of eco-industrial parks.

3.2. Research hypotheses

On the premise that technology, economic endowment, and consumer demand remain unchanged, the introduction of environmental regulation will only increase the cost burden of enterprises, limit the output of enterprises, and weaken the competitiveness of enterprises (Gray & Shadbegian, 2003). Enterprises must make corresponding adjustments to their product structures, organizational structures, management modes, and technology levels to offset the rising costs if they are to survive (Xie et al., 2017). At this time, the enhancement of environmental regulation intensity will increase the possibility of enterprises exiting from the market. Based on the dynamic perspective, Porter and Linde (1995) believe that appropriate environmental regulations can motivate enterprises to improve their technological level and management efficiency, thus enabling enterprises to obtain 'innovation compensation'. When the 'innovation compensation' is equal to or exceeds the compliance cost brought by environmental regulations, the production efficiency, and competitiveness of enterprises will be improved, which is more conducive to the sustainable operation and long-term development of enterprises, and the survival probability of enterprises will increase, that is, the probability of enterprises exiting from the market will decline. In sum, the marginal cost of environmental governance and the marginal benefit of environmental incentives influence the market exit behavior of enterprises. For a specific industry, the promulgation and implementation of Cleaner Production Policy means that the relevant industry is faced with enhanced environmental regulation, so what impact will implementation of the policy have on the regulated enterprises? Therefore, the following hypothesis is proposed:

Hypothesis 1. *The implementation of Cleaner Production Standards will reduce the probability of enterprise exit and increase the probability of enterprise survival.*

Compared with the previous environmental regulation policies of terminal control, Cleaner Production Standards pay more attention to pollutant source control and emphasize the greening of production processes, which has higher requirements for equipment update and production process improvement. Production process innovation makes it possible to produce a certain number of goods and services with less inputs (Manuel et al., 2007). In this way, enterprise TFP will be improved, enterprises can rely on the advantage of productivity to build a competitive advantage which is more conducive to the survival and long-term development of enterprises, making them less likely to exit the market. In addition, environmental policies targeting the production process may also cause regulated enterprises to change their product mix (Elrod & Malik, 2017). Faced with environmental regulation, multi-product enterprises may abandon the products that produce a lot of pollution in the production process and turn to cleaner products with less pollution, thus increasing their willingness to innovate. Product innovation not only enables companies to meet changing consumer needs in a timely manner, but also continuously creates and enhances value in their products. Therefore, product innovation provides a platform for enterprises to better represent revenue and meet consumer demand compared to their competitors, thus achieving better market performance (Kim & Mauborgne, 1998). In addition, with improved overall environmental protection awareness in society, consumers' preferences gradually shift to environmental protection and health products. Such changes will undoubtedly affect the adjustment of strategic decisions of enterprises, promote enterprises to produce more environmentally-friendly products, and the proportion of new product output value will rise. Moreover, article 14 of the Clean Production Promotion Law also points out that it shall guide and support the research and development of clean production technologies and products conducive to environmental and resource protection. Therefore, the following hypothesis is proposed:

Hypothesis 2. *The implementation of Cleaner Production Standards affects the probability of enterprises exiting the market by influencing enterprise TFP and product innovation.*

4. Econometric model, index construction, and data specification

4.1. Econometric model

To effectively identify the impact of implementing Cleaner Production Standards on the exit behavior of enterprises, the multiperiod DID method which is suitable for the specific situation of the implementation of the policy is used to test the effect of the standards (Yang et al., 2022). Since enterprise exit is a binary selection process, a Probit regression model was used by referring to Eslava et al. (2013). The model is configured as follows:

$$\Pr(Exit_{ijpt}) = \beta_0 + \beta_1 treat_{\mathrm{jt}} \times post_{\mathrm{it}} + \gamma X_{ijpt} + \delta_{\mathrm{j}} + \delta_p + \delta_{\mathrm{t}} + \mu_{ijpt} \quad (1)$$

where i represents the enterprise and t represents the year. $Exit_{ijpt}$ represents the market exit behavior of the enterprise. If the enterprise exits the market in year $t+1$, the observed value in year t of the enterprise is 1; otherwise, the observed value is 0. $treat_{\mathrm{jt}}$ is a dummy variable of the treatment group. If Clean Production Standards are implemented in the 4-digit industry j where the enterprise is located, the value of this variable is 1; otherwise, it is 0. $post_{\mathrm{it}}$ is a time dummy variable of the treatment group. If the 4-digit industry in which enterprise i implements Cleaner Production Standards in year t, the value of this variable is 1; otherwise, it is 0. The cross product of $treat_{\mathrm{jt}}$ and $post_{\mathrm{it}}$ reflects the impact of cleaner production policies on enterprise exit behavior. X_{ijpt} is a matrix of control variables, including other factors that influence the enterprise's exit behavior. δ_{j}, δ_p, δ_{t} are dummy variables of 2-digit industry, province, and time dummy variables, respectively μ_{ijpt} is the random disturbance term.

4.2. Construction of indicators

4.2.1. Explained variable

Enterprise exit (*Exit*). This paper adopts a similar approach to Dunne et al. (1988) and Disney et al. (2003). Specifically, if enterprise i exists in year t, but does not exist in year $t+1$ and beyond, then enterprise i exits in year t and *Exit* is 1, otherwise, it is 0. However, enterprises may also temporarily exit the market because of missing information, code changes, or lower sales. Therefore, we deal with the data as follows. First, for enterprises that change their codes, this paper adopts a similar approach to Brandt et al. (2012). Check the enterprise code with the enterprise name, zip code, industry code, and legal representative information, and rematch those enterprises that did not actually leave because of the code change. Second, because the database of Chinese industrial enterprises includes state-owned and non-state-owned enterprises above a designated size, this means that the disappearance of corporate legal person code, probably because non-state-owned enterprises have changed from above scale to below scale, some existing enterprises may be misjudged as exiting enterprises. Therefore, when an enterprise disappears in some years and reappears in some years, we regard it as a surviving enterprise to avoid overestimating the enterprise exit rate.

4.2.2. Explanatory variable

Quadratic difference term ($treat_{jt} \times post_{it}$). In this paper, the construction of the quadratic difference term is based on the Clean Production Standard information of the official website of the Ministry of Environmental Protection of China. Up to 2010, a total of 58 Cleaner Production Standards have been issued, including 34 manufacturing industry standards within the sample period of this paper. In terms of industry setting, since the Cleaner Production Standard does not specify the 4-digit industry code involved, this paper finds the corresponding 4-digit industry code according to the applicable business scope in the Cleaner Production Standard and combined with the selected data of manufacturing enterprises, referring to the Industry classification and code of national economy (GB 4754-2011). In terms of time setting, this paper takes the implementation year of the cleaner production standard. If a 4-digit industry implements the standard before June 30 in year t, then the year t and subsequent years of the four-digit industry are set as 1. If a 4-digit industry implements the standard after June 30 in year t, the four-digit industry's year $t+1$ and subsequent years are set to 1. In view of the fact that Cleaner Production Standards have been revised for individual industries, this paper only follows the standards implemented for the first time. Industries covered by Cleaner Production Standards are shown in Table 1.

4.2.3. Control variables

Enterprise scale (*Scale*): Refer to the method of Zhang et al. (2019). The natural logarithm of the total assets of an enterprise is used to measure the size of the enterprise. The larger an enterprise is, the more incentive local governments have to protect it, the more likely it is to survive, and the less likely it is to exit the market. The expected sign is negative.

Enterprise TFP: Considering the availability of data, refer to the method of Hoch (1962). In this paper, the panel fixed effect method (FE) is used to estimate and measure the residual in the regression function as enterprise TFP. The specific regression equation is as follows:

$$\ln REV_{ijpt} = \beta_1 \ln K_{ijpt} + \beta_2 \ln L_{ijpt} + \eta_j + \eta_p + \eta_t + \omega_{ijpt} + \mu_{ijpt} \quad (2)$$

where REV_{ijpt} is the main business income, K_{ijpt} is the assets of the enterprise, and L_{ijpt} is the number of employees. η_j, η_p, and η_t are fixed effects of industry, province, and time, respectively. Residual ω_{ijpt} represents the TFP of an enterprise, including the technological level and management efficiency of the enterprise. μ_{ijpt} is a random error independent of factor input. Generally speaking, the higher an enterprise's TFP, the less likely it is to exit the market. The expected sign is negative.

Enterprises profit level (*profit*): Referring to the method of Titah et al. (2016), this paper uses the ratio of profit income to sales income of enterprises. Generally

Table 1. Industries subjected to clean production standards.

Implementation year	Industry
2003	Tanning industry, oil refining industry, coking industry
2006	Edible vegetable oil industry, sugarcane sugar industry, beer manufacturing industry, textile industry, basic chemical raw material manufacturing industry, nitrogen fertilizer manufacturing industry, electrolytic aluminum industry, steel industry, automobile manufacturing industry
2007	Dairy products manufacturing industry, artificial board industry, paper industry, steel industry, electroplating industry, electrolytic manganese industry, chemical fiber industry, plate glass industry
2008	Tobacco processing industry, liquor manufacturing industry, chemical fiber industry, monosodium glutamate industry, starch industry
2009	Battery industry, synthetic leather industry, wine manufacturing industry, cement industry, soda ash industry, chlor-alkali industry
2010	Crude lead smelting industry, copper smelting industry, alcohol manufacturing industry

Source: Ministry of Environmental Protection's official website 'Cleaner Production Standards'; related industries have been collated for tractability.

speaking, enterprises with higher profits and good operating conditions are less likely to exit the market, and the expected sign is negative.

Enterprise age (*age*): Consistent with the method of Xu (2012), the age of an enterprise is measured by the time of establishment of the enterprise. In other words, the current year minus the year of establishment of the enterprise plus 1 is used to measure the age of the enterprise. Generally speaking, the longer the enterprise operates, the greater the management experience and the higher the capital accumulation, the less likely it is to exit the market. The expected sign is negative.

Enterprise debt (*debt*): According to the method of Xu (2012), the total liabilities of the enterprise are divided by the total assets. On the one hand, companies with higher debts face greater repayment pressure and are more likely to be forced out of the market because they cannot pay off their debts. On the other hand, high debt will lower the credit rating of enterprises, increase the cost of financial crisis, and increase the difficulty for enterprises to raise funds in the market, thus increasing the probability of enterprises exiting the market. The expected sign is positive.

Market concentration rate (*HHI*): By referring to Chikoto et al. (2016), the sum of squares of enterprise sales accounted for the total industry sales, and the equation is as follows:

$$HHI = \sum_{\mathrm{i}=1}^{N} (X_{\mathrm{i}}/X)^2 = \sum_{\mathrm{i}=1}^{N} S_i^2 \tag{3}$$

where X is the total market sales of the industry, X_{i} is the sales of the industry in which the enterprise is located, and S_i is the market share of the enterprise. The higher the value of *HHI*, the higher the market concentration and the higher the monopoly degree. The process of increasing the degree of market concentration is usually accompanied by the weak competitiveness and thus there is a positive relationship with enterprise exit behavior. The expected sign is positive.

Enterprise export proportion (Export): Similar to Yang et al. (2017), the proportion of an enterprises exports in their gross output value is used. As more and more international companies trade with Chinese companies (Su et al., 2019b; Wang et al.,

Table 2. Descriptive statistics.

Variables	Mean value	Std. dev.	Min	Median	Max	Observations
Exit	0.06	0.23	0.00	0.00	1.00	2897598
treat × *post*	0.05	0.22	0.00	0.00	1.00	2897598
scale	10.03	1.41	7.24	9.89	14.12	2897429
age	2.94	0.34	2.20	2.89	4.13	2897597
profit	7.19	2.00	2.20	7.18	11.85	2468359
debt	0.54	0.28	0.01	0.56	1.27	2895663
TFP	0.00	0.88	−2.18	−0.03	2.31	2055835
HHI	130.73	183.46	8.79	67.13	1143.50	2897598
Export	0.17	0.33	0.00	0.00	1.01	2576377

Source: Authors' calculations.

2022a, 2022b), their imports and exports will also affect the exit of enterprises. Compared with enterprises that do not participate in commodity exports, export enterprises are subject to more environmental constraints when facing the international market and need to pay higher sunk costs. Therefore, the higher the proportion of exports, the higher the survival probability. The expected sign is negative.

Next, descriptive statistics for each variable are reported in Table 2.

4.3. Data

The data used in this paper are from the *Database of Chinese Industrial Enterprises* established by the National Bureau of Statistics. The statistical objects include all state-owned enterprises and non-state-owned enterprises above the scale from 2003 to 2013, providing relatively comprehensive micro enterprise information. There are some problems in the database, such as lack of indicators and abnormal indicators. If the original data are not processed appropriately, the obtained results are likely to be unstable. Therefore, this paper deals with missing values and outliers by referring to Brandt et al. (2012) and Feenstra et al. (2014). First, enterprises with less than 8 employees are removed from the sample. Second, enterprises with negative current assets, fixed assets, net fixed assets, and total sales were excluded. Third, enterprises with current assets, fixed assets, and net fixed assets exceeding total assets were removed. Finally, the negative samples of foreign capital, paid-in capital and state-owned capital are deleted. At the same time, this paper reserved the manufacturing enterprises with 2-digit industry codes of 13 ∼ 43, and reduced the tail of control variables by 1% before and after.

5. Empirical analysis

5.1. Basic regression results

The explanatory variable coefficient of the Probit regression model is not the marginal effect of each variable, but the change value of the probability density function after each increment of the independent variable. The baseline regression results are reported in Table 3. It can be found that in the process of gradually adding each control variable, the coefficient of the quadratic term *treat* × *post* of model (1)–(8) is negative, which is significant at the 1% level, indicating that there is a negative relationship between the implementation of Cleaner Production Standards and the exit of enterprises. The probability of enterprise exit decreases with the increase in environmental regulation, that is, the implementation of Cleaner Production Standards reduces the probability of enterprise exit. This shows that enterprises' concern that the implementation of the standards will lead to an increase in their operating costs and weaken their competitiveness is unnecessary. Enterprises can also ensure their competitiveness through other means while completing cleaner production. Hypothesis 1 is verified in this paper.

The relationship between enterprise size and enterprise exit is statistically significant at the 1% level. This result indicates that the larger the enterprise is, the more likely it is to survive in the long run and the lower the probability of its exit from the market (Audia & Greve, 2006). The regression coefficient of enterprise age is negative at the significance level of 1%. The reason is that the longer the enterprise is in business, the more experience it has and the stronger its capital base, the less likely it is to exit the market. The regression coefficient of enterprise profit level is negative and significant at the 1% level. This indicates that enterprises with high profitability and good business performance are less likely to exit the market. The coefficient of corporate debt level is significantly positive, but with the addition of other control variables, the significance level gradually decreases, indicating that enterprises with a large amount of debt have greater repayment pressure and financial difficulties will increase the probability of enterprises exiting the market (Zingales, 1998). The coefficient of TFP is always negative at the 1% level, indicating that enterprises with higher technology level and stronger management ability are less likely to exit the market. The *HHI* coefficient of regional market concentration is positive at the 1% significance level. This indicates that the increase in regional market concentration, that is, the

Table 3. Basic regression results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
treat × *post*	−0.148***	−0.063***	−0.056***	−0.059***	−0.058***	−0.077***	−0.077***	−0.093***
	(−15.97)	(−6.57)	(−5.76)	(−5.49)	(−5.42)	(−6.33)	(−6.37)	(−7.66)
scale		−0.247***	−0.237***	−0.214***	−0.212***	−0.228***	−0.229***	−0.224***
		(−186.56)	(−177.58)	(−123.62)	(−122.02)	(−119.76)	(−119.87)	(−116.84)
age			−0.294***	−0.430***	−0.428***	−0.325***	−0.325***	−0.319***
			(−52.54)	(−64.13)	(−63.87)	(−45.94)	(−45.98)	(−45.37)
profit				−0.050***	−0.051***	−0.031***	−0.031***	−0.031***
				(−49.59)	(−49.17)	(−25.77)	(−25.76)	(−25.38)
debt					0.031***	0.014**	0.014**	0.015**
					(5.03)	(2.18)	(2.16)	(2.26)
TFP						−0.094***	−0.094***	−0.095***
						(−37.19)	(−37.21)	(−37.68)
HHI							0.000***	0.000***
							(6.96)	(6.43)
Export								−0.252***
								(−39.29)
Constant	−0.827***	1.493***	2.367***	2.790***	2.799***	2.517***	2.511***	2.466***
	(−72.17)	(87.71)	(97.76)	(96.78)	(96.76)	(82.16)	(81.97)	(80.53)
Province-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2603438	2603297	2603296	2203344	2202409	1714520	1714520	1713584
Pseudo R^2	0.131	0.170	0.172	0.187	0.187	0.178	0.178	0.180

Note: All regression combinations are the results of Probit regression. The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. *Z* statistics are in parentheses.
Source: Authors' calculations.

increase in monopoly degree, is more likely to cause some inefficient and uncompetitive enterprises to choose to exit the market. The coefficient of enterprises' export proportion is significantly negative at the 1% level, indicating that the high sunk cost of entering the international market makes export enterprises more reluctant to exit the market.

5.2. Robustness test

5.2.1. Parallel trend test

The common trend hypothesis is an important prerequisite for obtaining unbiased estimates using the DID method. That is, it is assumed that in the absence of Cleaner Production Standards, the enterprise exit probability of the treatment group and the control group will not change significantly over time. If other factors before the implementation of the standards lead to significant changes in the probability of enterprise exit, then the common trend hypothesis may not hold and unbiased regression results cannot be guaranteed. This paper uses the following equations to test the common trend:

$$Exit_{ijpt} = \sum\nolimits_{\tau \in \{-3,-2,-1,0\}} \alpha_\tau treat_{j\tau} \times post_{i\tau} + \gamma X_{ijpt} + \delta_j + \delta_p + \delta_t + \mu_{ijpt} \quad (4)$$

where $-3 \leq \tau \leq 0$, indicating that the 4-digit industry in which company i is located has implemented Cleaner Production Standards in 0 years and 3 years with a lag. If the lag coefficients α_{-1}, α_{-2}, α_{-3} are not significant, it indicates that other factors before the implementation of the standards do not affect the results.

In addition to using Probit regression, Logit regression and panel fixed effect regression (FE) are added as robustness reference in this paper. Among them, the difference between logit and probit is that the random variable is assumed to obey the logical probability distribution. Panel fixing effect is essentially based on OLS method, which can estimate the model with the explained variable as dummy variable. Although the estimated coefficient obtained is different from the previous two methods, the direction of effect and robustness are basically the same. Therefore, the panel fixing effect model is adopted for robustness test. Using three different models makes the results more robust, rather than an accident of model selection.

The regression results are shown in Table 4. It is worth noting that due to the limitation of the time interval of the data, the industries that implemented the Cleaner Production Standard in 2003, namely tanning industry, petroleum refining industry and coking industry, could not be investigated in the years before 2003. However, due to the relatively small proportion of these industries, they have little impact on the overall results, so the test results of parallel trends in this paper are still robust and effective. In all samples, the estimated coefficient significance of the quadratic term $treat \times post_{-n}$ ($n = 1, 2, 3$) that measures the effect of Cleaner Production Standards before implementation decreased, and the estimated coefficients of $treat \times post_{-2}$ and $treat \times post_{-3}$ are not significant at the 10% significance level. This indicates that there is no significant difference in the enterprise exit probability between the treatment group and the control group before the implementation of Cleaner

Table 4. Parallel trend test.

Variable	Probit (1)	Logit (2)	FE (3)
$treat \times post_0$	−0.094*** (−7.75)	−0.309*** (−16.05)	−0.003*** (−7.89)
$treat \times post_{-1}$	−0.005 (−0.30)	−0.011 (−0.38)	−0.002* (−1.73)
$treat \times post_{-2}$	0.002 (0.12)	0.015 (0.53)	0.001 (1.01)
$treat \times post_{-3}$	0.006 (0.38)	0.000 (0.01)	−0.001 (−0.63)
Control variable	Yes	Yes	Yes
Province-Fixed effect	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes
Observations	1713584	1713584	1713584
Pseudo R^2 (or R^2)	0.148	0.152	0.0303

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. *z* statistics or *t* statistics are in parentheses.
Source: Authors' calculations.

Production Standards, which can basically eliminate the concern of a non-parallel trend caused by other factors before the implementation of the standards.

5.2.2. Test based on PSM-DID method

Considering that there may be bias when using the whole sample to investigate causality (Wang et al., 2019b), in order to reduce the estimation bias caused by possible sample selection bias, this paper adopts a combination of Propensity Score Matching (PSM) and DID method for robust estimation (Zhang et al., 2022a). First, enterprises with similar characteristics are selected. The nearest neighbor matching method is adopted, and 1:2 ratio is selected for matching. When predicting the propensity score of enterprises to implement Cleaner Production Standards, the control variable in model (1) was selected as the matching characteristic variable, and the Logit model was used for regression estimation. Figure 1 shows the kernel density before and after matching. Table 5 shows the balancing test results before and after the match. We can find that the standard deviation of the matching variable after the match is greatly reduced, and after the match variables are less than 5% of the absolute value of the standard deviation, which suggests that the matching effect is good (Rosenbaum & Rubin, 1985).

Table 6 shows the results after screening samples by Propensity Score Matching (PSM), and there is still a negative relationship between *Cleaner Production Standards* and enterprise exit. Moreover, the estimated coefficients in columns (1), (3), and (5) without control variables were still significant at the 1% level, while the coefficients in columns (2), (4), and (6) without control variables were significantly lower, but still significant at the 10% significance level. There is no significant difference between the PSM-DID estimation results and the results of the DID method mentioned above, which further supports the conclusion of this paper that the implementation of Cleaner Production Standards reduces the probability of enterprise exit.

5.2.3. Other policy shocks

Since 2005, the National Development and Reform Commission has released 30 production evaluation index systems for industrial enterprises to evaluate their cleaner production levels. The implementation of Cleaner Production Standards overlapped

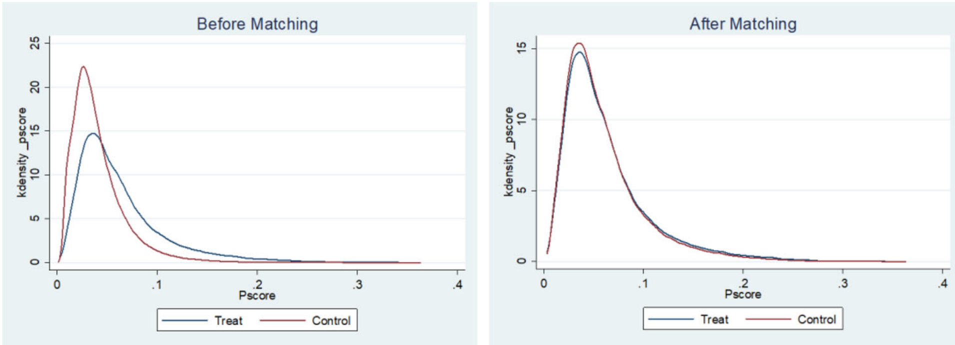

Figure 1. Pre-matching kernel density figure and post-matching kernel density figure.
Source: Authors' calculations.

Table 5. Balancing inspection before and after the match.

		Mean		
Variable	Sample	Treatment group	Control group	Standard deviation %
scale	Before the match	10.238	9.7013	35.3
	After the match	10.238	10.268	−2.0
age	Before the match	2.9295	2.9982	−21.9
	After the match	2.9295	2.9333	−1.2
profit	Before the match	7.343	6.7322	29.6
	After the match	7.343	7.3677	−1.2
debt	Before the match	0.54895	0.53264	5.9
	After the match	0.54895	0.54841	0.2
TFP	Before the match	0.49885	0.07524	46.4
	After the match	0.49885	0.51338	−1.6
HHI	Before the match	150.08	147.86	1.0
	After the match	150.08	150.82	−0.3
Export	Before the match	0.08122	0.16069	−25.4
	After the match	0.08122	0.08985	−2.8

Source: Authors' calculations.

with the implementation of Cleaner Production Evaluation Index System during 2005-2009. To better identify the impact of Cleaner Production Standards, the quadratic item $otreat_{jt} \times opost_{it}$ of industry and year of Cleaner Production Evaluation Index System is included in equation (1) in this paper. Table 7 shows the regression results. From the results, we can see that although the absolute value of the quadratic term coefficient of Cleaner Production Standards has decreased somewhat, there is still a significant negative relationship between Cleaner Production Standards and enterprise exit, which indicates that the policy effect of the standards still exists after controlling the impact of other policies, indicating that the results of this paper are robust.

5.3. Influencing mechanism analysis

According to the influencing mechanism analysis in this paper, the implementation of Cleaner Production Standards can influence the exit behavior of enterprises by affecting enterprise TFP and enterprise product innovation. Therefore, based on the analysis method of Zhang et al. (2019) for the potential influencing mechanism, this paper tests the following estimated equation:

Table 6. Regression results of PSM-DID.

	Probit		Logit		FE	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
treat × *post*	−0.131***	−0.119**	−0.301***	−0.246*	−0.002***	−0.001**
	(−3.40)	(−2.56)	(−2.59)	(−1.79)	(−4.60)	(−2.32)
Control variable	No	Yes	No	Yes	No	Yes
Province-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	203398	203398	203398	203398	203415	203415
Pseudo R^2 (or R^2)	0.2071	0.1445	0.1447	0.2113	0.0365	0.0303

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. *z* statistics or *t* statistics are in parentheses.
Source: Authors' calculations.

Table 7. Other policy shocks.

	Probit		Logit		FE	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
treat × *post*	−0.131***	−0.086***	−0.271***	−0.157***	−0.001***	−0.001***
	(−14.00)	(-6.93)	(−13.90)	(−6.38)	(−6.03)	(−4.12)
otreat × *opost*	−0.055***	−0.021**	−0.117***	−0.043**	−0.000	−0.000
	(−8.07)	(−2.43)	(−8.42)	(−2.53)	(−0.17)	(−0.52)
Control variable	No	Yes	No	Yes	No	Yes
Province-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2603438	1713584	2603438	1713584	2897598	1713584
Pseudo R^2 (or R^2)	0.131	0.180	0.131	0.184	0.051	0.042

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. *Z* statistics or *t* statistics are in parentheses.
Source: Authors' calculations.

$$Inno_{ijpt} = \alpha_0 + \alpha_1 treat_{\mathrm{jt}} \times post_{\mathrm{it}} + \alpha_3 X_{ijpt} + \kappa_{\mathrm{j}} + \kappa_p + \kappa_{\mathrm{t}} + \Psi_{ijpt} \tag{5}$$

$$TFP_{ijpt} = \omega_0 + \omega_1 treat_{\mathrm{jt}} \times post_{\mathrm{it}} + \omega_3 M_{ijpt} + \lambda_{\mathrm{j}} + \lambda_p + \lambda_{\mathrm{t}} + \varphi_{ijpt} \tag{6}$$

Among them, the settings of independent variables $treat_{\mathrm{jt}}$, $post_{\mathrm{it}}$ and control variable X_{ijpt} are consistent with the basic model. In equation (5), $Inno_{ijpt}$ represents product innovation and is measured by the ratio of new product output value to total industrial output value. κ_{j}, κ_p, and κ_{t} represent the 2-digit industry, province, and time-fixed effect, respectively. In equation (6), TFP_{ijpt} is the enterprise total factor productivity, and the control variable M_{ijpt} is the variable after the TFP is removed. λ_{j}, λ_p and λ_{t} represent the 2-digit industry, province, and time-fixed effect, respectively. Ψ_{ijpt}, φ_{ijpt} are the random disturbance terms of equation (5) and equation (6) respectively.

According to hypothesis 2, it can be seen that the implementation of Cleaner Production Standards may affect the exit probability of enterprises by improving enterprise TFP and product innovation level. Table 8 shows the results of the influencing mechanism test, from which we can find that, with or without control variables, the regression coefficients of quadratic terms in model (1) and (2) are all positive and significant at the 1% level. This indicates that the implementation of

Table 8. Test results of influence mechanism.

Variable	(1) *Inno*	(2) *Inno*	(3) *TFP*	(4) *TFP*
treat × *post*	0.003*** (4.45)	0.003*** (4.54)	0.017*** (4.58)	0.013*** (4.72)
Control variable	No	Yes	No	Yes
Province-Fixed effect	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes
Observations	1816434	1525093	2055835	1713584
R^2	0.023	0.026	0.163	0.173

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level are regressed. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. *t* statistics are in parentheses.
Source: Authors' calculations.

Cleaner Production Standards increases the output value of new products, and regulated enterprises can produce green products that are more popular in the market. The increase in market share is conducive to the survival of enterprises, thus reducing the risk of enterprises exiting the market. The quadratic terms regression coefficients in model (3) and (4) are positive and significant at the 1% level. This indicates that the process innovation of Cleaner Production Standards can promote the improvement of enterprise TFP, which is consistent with the view of Manuel et al. (2007). To sum up, the implementation of Cleaner Production Standards increases the survival probability of enterprises by improving enterprise TFP and product innovation. Hypothesis 2 in this paper is verified.

5.4. Further study: heterogeneity

5.4.1. Enterprise ownership and R&D intensity

To test the impact of enterprise ownership and R&D intensity on enterprise exit behavior, a method similar to that of Hering and Poncet (2014) was adopted. Two kinds of attributes and the establishment of cubic interaction terms are included in the equation, and the Difference-in-Differences-in-Differences (DDD) model is established. The estimated equation is as follows:

$$\Pr(Exit_{ijpt}) = \alpha_0 + \alpha_1 treat_{\mathrm{jt}} \times post_{\mathrm{it}} \times RD_{\mathrm{j}} + \alpha_2 treat_{\mathrm{jt}} \times RD_{\mathrm{j}} + \alpha_3 post_{\mathrm{it}} \times RD_{\mathrm{j}} + \alpha_4 treat_{\mathrm{jt}} \times post_{\mathrm{it}} + \gamma X_{ijpt} + \delta_{\mathrm{j}} + \delta_p + \delta_{\mathrm{t}} + \mu_{ijpt} \quad (7)$$

$$\Pr(Exit_{ijpt}) = \beta_0 + \beta_1 treat_{\mathrm{jt}} \times post_{\mathrm{it}} \times SOE_{\mathrm{i}} + \beta_2 treat_{\mathrm{jt}} \times SOE_{\mathrm{i}} + \beta_3 post_{\mathrm{it}} \times SOE_{\mathrm{i}} + \beta_4 treat_{\mathrm{jt}} \times post_{\mathrm{it}} + \gamma X_{ijpt} + \delta_{\mathrm{j}} + \delta_p + \delta_{\mathrm{t}} + \mu_{ijpt} \quad (8)$$

where industry R&D intensity refers to Shao et al. (2019) and calculates the ratio of industry R&D input to total industrial output value. Industries are divided into R&D intensive and non-R&D intensive industries based on the median R&D intensity of all samples. If the R&D intensity of the industry is greater than the median, it is an R&D intensive industry, $RD = 1$; Otherwise, for non-R&D intensive industries, $RD = 0$. According to the registration type information in the database, state-owned enterprises

Table 9. Test results of enterprise ownership and R&D intensity.

Variable	(1)	(2)	(3)	(4)
treat × *post* × *RD*	−0.168*** (−2.64)	−0.119*** (−2.74)		
treat × *post* × *SOE*			0.281*** (5.57)	0.187** (2.35)
treat × *RD*	−0.009 (−0.32)	0.049 (1.46)		
post × *RD*	0.031 (0.24)	0.479*** (4.37)		
treat × *SOE*			0.087*** (10.80)	0.048*** (4.81)
post × *SOE*			0.118 (1.05)	0.467** (2.05)
treat × *post*	−0.023 (−0.16)	−0.448*** (−3.68)	−0.251** (−2.21)	−0.593*** (−2.60)
Control variable	No	Yes	No	Yes
Province-Fixed effect	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes
Observations	2603438	1713584	2603438	1713584
Pseudo R^2	0.131	0.180	0.131	0.180

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; *z* statistics are in parentheses.
Source: Authors' calculations.

(110), state-owned joint ventures (141), state-owned and collective joint ventures (143) and wholly state-owned companies (151) are classified into state-owned types. At this point, $SOE = 1$. Otherwise, it is a non-state-owned enterprise, $SOE = 0$.

This paper focuses on the estimation coefficients $treat_{jt} \times post_{it} \times RD_j$ and $treat_{jt} \times post_{it} \times SOE_i$ of α_1 and β_1, that is, the estimators of the cubic interaction terms. As can be seen from Table 9, for R&D intensive industries, the relationship between the cubic interaction terms and enterprise exit is significantly negative, that is, compared with non-R&D intensive industries, the implementation of Cleaner Production Standards reduces the probability of market exit of R&D intensive enterprises. This may because, on the one hand, R&D intensive industries are more innovative, and enterprises can adapt to the strict technological process requirements of Cleaner Production Standards through their own innovation. On the other hand, R&D intensive industries have strong absorption capacity, and enterprises are good at transforming environmental protection technologies into their own productivity improvement through technical cooperation (Costantini & Mazzanti, 2012), thus reducing the probability of enterprises exiting the market. In terms of enterprise ownership test, there is a positive relationship between the three interaction terms and enterprise exit, which is valid at the significance level of more than 10%. That compared to the non-state enterprises, *Cleaner Production Standards* to improve the probability of state-owned enterprises to exit the market, it shows that when the become rigid binding political task of the energy saving and emission reduction, to reform of state-owned enterprises in the merger and reorganization, high investment, high pollution, energy intensive, low efficiency of state-owned companies tend to take the lead in becoming bankrupt mergers and reorganization of the object, therefore, compared with other ownership enterprises, state-owned enterprises are the probability of exit the market will be higher.

5.4.2. Enterprise size heterogeneity

To examine the heterogeneity of the impact of Cleaner Production Standards on the market exit probability of enterprises of different sizes, indicators of enterprise size are arranged from small to large, and grouped according to 5%, 25%, 50%, 75% and

Table 10. Results of enterprise scale test.

Variable	(1) <P5	(2) P5-P25	(3) P25-P50	(4) P50-P75	(5) P75-P95	(6) >P95
treat × *post*	0.019**	−0.081***	−0.045**	−0.056**	−0.056	0. 016
	(2.14)	(−3.74)	(−1.98)	(−1.96)	(−1.50)	(1.46)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Province-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	115816	449736	469002	367401	251058	60173
Pseudo R^2	0.190	0.165	0.137	0.127	0.137	0.167

Note: The regression was carried out by using standard errors that cluster at the 4-digit industry level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; *z* statistics are in parentheses.
Source: Authors' calculations.

95% points, and the grouped samples are used for regression (Su et al., 2022b; Zhang et al., 2022b). The estimated results are reported in Table 10. In the samples with subfractions less than 5%, the estimated coefficient of the quadratic term is positive, indicating that the standards increase the probability of smaller enterprises exiting the market. For samples ranging from 5% to 25%, 25% to 50%, and 50% to 75%, the quadratic coefficient is negative, indicating that the implementation of the standards reduces the probability of enterprise exit. For the samples with more than 75% subdivision, Cleaner Production Standards have no significant influence on enterprise exit. The results of grouping regression show that for small enterprises below 5%, the implementation of the standards means higher transformation and upgrading costs, and the probability of exiting the market will increase. When scattered and disorderly enterprises are forced to be eliminated, production factors or resources will be concentrated on high-quality enterprises to realize the optimal allocation of production factors among enterprises; for enterprises with a score between 5% and 75%, the internal division of labor is more detailed, the management system is more sound, and the technology research and development capability is stronger. The implementation of Cleaner Production Standards will help these enterprises leverage economies of scale and survive in the market. Enterprises above 75% are strong, and they play a decisive role in local economic development. From beginning to end, they are strictly controlled by the government, and the implementation of Cleaner Production Standards has a limited impact on these enterprises.

6. Conclusions and policy implications

Based on the Cleaner Production Standards implemented since 2003 as a quasi-natural experiment, this paper empirically analyzed the impact of these standards on the exit behavior of enterprises by using micro data covering Chinese manufacturing enterprises from 2003 to 2013 and a DID method. The findings are as follows. The implementation of Cleaner Production Standards can effectively reduce the probability of enterprises exiting the market. This finding was verified by using a parallel trend test, Propensity Score Matching (PSM), and excluding other policy factors. The influencing mechanism test shows that, on the one hand, the implementation of Cleaner Production Standards helps enterprises to improve TFP and reduces the probability of enterprises exiting the market by relying on the low-cost advantage of efficient production; on the other hand, the implementation of these standards can stimulate enterprises to carry out product innovation, produce environmentally friendly products that cater to consumers' preferences, gain more market share, and reduce the probability of enterprise exit. In the heterogeneity analysis, it was found that the implementation of the Cleaner Production Standards reduced the market exit probability of R&D intensive industries and enterprises with a scale of 5%-75%; for state-owned enterprises and enterprises whose scale is less than 5%, Cleaner Production Standards increase the probability that they will exit the market.

Based on the above conclusions, this paper puts forward the following suggestions.

It is necessary to conscientiously implement the Clean Production Promotion Law and set standards for emission reduction or emission reduction technologies in the production process. Our research shows that the implementation of Cleaner Production Standards can effectively reduce the probability of enterprise exit and improve the market competitiveness and viability of enterprises. Therefore, the concept of cleaner production should be further promoted and popularized, and the environmental strategy of overall prevention should be continuously applied to the production process, products, and services of enterprises. It should gradually evolve into an approach focused on reducing pollution at source. At the same time, there is a need for increased government support for cleaner production, training of relevant personnel for cleaner production, and further strengthening of enterprises' cleaner production capacity, with the ultimate aim of achieving high-quality economic development in China.

It is necessary to improve national policy incentives to increase the enthusiasm of enterprises to implement cleaner production. The results show that Cleaner Production Standards have a positive impact on enterprise TFP and green product innovation. Local governments may provide green subsidies to investors, encourage them to invest in green production, and motivate enterprises to engage in cleaner production. They can also subsidize consumers of green products which will reduce the cost of purchasing green products, promote consumers to choose more green products, gradually cultivate consumers' awareness of green consumption, and thus improve the public's awareness of environmental protection.

Cleaner production should be implemented in different ways. The results of this paper show that Cleaner Production Standards have a stronger protective effect on R&D intensive and medium-sized enterprises, so it is necessary to further strengthen the guidance for non-R&D intensive and small enterprises. It is obviously not appropriate to formulate a 'one-size-fits-all' scheme.

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References

Audia, P. G., & Greve, H. R. (2006). Less likely to fail: Low performance, firm size, and factory expansion in the shipbuilding industry. *Management Science*, *52*(1), 83–94. https://doi.org/10.1287/mnsc.1050.0446

Berman, E., & Bui, L. T. M. (2001). Environmental regulation and productivity: Evidence from oil refineries. *Review of Economics and Statistics*, *83*(3), 498–510. https://doi.org/10.1162/00346530152480144

Boyd, G. A., & McClelland, J. D. (1999). The impact of environmental constraints on productivity improvement in integrated paper plants. *Journal of Environmental Economics and Management*, *38*(2), 121–142. https://doi.org/10.1006/jeem.1999.1082

Brandt, L., Biesebroeck, J. V., & Zhang, Y. (2012). Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing. *Journal of Development Economics*, *97*(2), 339–351. https://doi.org/10.1016/j.jdeveco.2011.02.002

Cai, X., Lu, Y., Wu, M., & Yu, L. (2016). Does environmental regulation drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China. *Journal of Development Economics*, *123*, 73–85. https://doi.org/10.1016/j.jdeveco.2016.08.003

Chang, C.-L., & Fang, M. (2023). Impact of a sharing economy and green energy on achieving sustainable economic development: Evidence from a novel NARDL model. *Journal of Innovation & Knowledge*, *8*(1), 100297. https://doi.org/10.1016/j.jik.2022.100297

Chikoto, G. L., Ling, Q., & Neely, D. G. (2016). The adoption and use of the Hirschman–Herfindahl index in nonprofit research: Does revenue diversification measurement matter? *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, *27*(3), 1425–1447. https://doi.org/10.1007/s11266-015-9562-6

Cohen, M. A., & Tubb, A. (2018). The impact of environmental regulation on firm and country competitiveness: A meta-analysis of the porter hypothesis. *Journal of the Association of Environmental and Resource Economists*, *5*(2), 371–399. https://doi.org/10.1086/695613

Costantini, V., & Mazzanti, M. (2012). On the green and innovative side of trade competitiveness? The impact of environmental policies and innovation on EU exports. *Research Policy*, *41*(1), 132–153. https://doi.org/10.1016/j.respol.2011.08.004

Disney, R., Haskel, J., & Heden, Y. (2003). Restructuring and productivity growth in UK manufacturing. *The Economic Journal*, *113*(489), 666–694. https://doi.org/10.1111/1468-0297.t01-1-00145

Dunne, T., Roberts, M. J., & Samuelson, L. (1988). Patterns of firm entry and exit in U.S. manufacturing industries. *The RAND Journal of Economics*, *19*(4), 495–515. https://doi.org/10.2307/2555454

Ejermo, O., & Xiao, J. (2014). Entrepreneurship and survival over the business cycle: How do new technology-based firms differ? *Small Business Economics*, *43*(2), 411–426. https://doi.org/10.1007/s11187-014-9543-y

Elrod, A. A., & Malik, A. S. (2017). The effect of environmental regulation on plant-level product mix: A study of EPA's Cluster Rule. *Journal of Environmental Economics and Management*, *83*, 164–184. https://doi.org/10.1016/j.jeem.2017.03.002

Eslava, M., Haltiwanger, J., Kugler, A., & Kugler, M. (2013). Trade and market selection: Evidence from manufacturing plants in Colombia. *Review of Economic Dynamics*, *16*(1), 135–158. https://doi.org/10.1016/j.red.2012.10.009

Feenstra, R. C., Li, Z., & Yu, M. (2014). Exports and credit constraints under incomplete information: Theory and evidence from China. *Review of Economics and Statistics*, *96*(4), 729–744. https://doi.org/10.1162/REST_a_00405

Ferragina, A. M., & Mazzotta, F. (2015). Agglomeration economies in Italy: Impact on heterogeneous firms'exit in a multilevel framework. *Economia e Politica Industriale*, *42*(4), 395–440. https://doi.org/10.1007/s40812-015-0016-3

Ferragina, A., Pittiglio, R., & Reganati, F. (2012). Multinational status and firm exit in the Italian manufacturing and service sectors. *Structural Change and Economic Dynamics*, *23*(4), 363–372. https://doi.org/10.1016/j.strueco.2011.10.002

Gray, W. B., & Shadbegian, R. J. (2003). Plant vintage, technology, and environmental regulation. *Journal of Environmental Economics and Management*, *46*(3), 384–402. https://doi.org/10.1016/S0095-0696(03)00031-7

Gray, W. B., & Shadbegian, R. J. (2001). Environmental regulation and manufacturing productivity at the plant level. NBER Working Paper, No. w4321.

Greenstone, M. (2002). The impacts of environmental regulations on industrial activity: Evidence from the 1970 and 1977 clean air act amendments and the census of manufactures. *Journal of Political Economy*, *110*(6), 1175–1219. [Database] https://doi.org/10.1086/342808

Greenstone, M., List, J. A., & Syverson, C. (2012). The effects of environmental regulation on the competitiveness of US manufacturing. *NBER Working Papers*, *93*(2), 431–435.

Hamamoto, M. (2006). Environmental regulation and the productivity of Japanese manufacturing industries. *Resource and Energy Economics*, *28*(4), 299–312. https://doi.org/10.1016/j.reseneeco.2005.11.001

Hering, L., & Poncet, S. (2014). Environmental policy and exports: Evidence from Chinese cities. *Journal of Environmental Economics and Management*, *68*(2), 296–318. https://doi.org/10.1016/j.jeem.2014.06.005

Hoch, I. (1962). Estimation of production function parameters combining time-series and cross-section data. *Econometrica*, *30*(1), 34–53. https://doi.org/10.2307/1911286

Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica*, *60*(5), 1127–1150.

Jackson, T. (2005). Exploring the economics of industrial ecology through case studies of industrial symbiosis in the forest industries of British Columbia and Scotland. *Progress in Industrial Ecology an International Journal*, *2*(2), 34–55.

Jefferson, G. H., Tanaka, S., & Yin, W. (2013). Environmental regulation and industrial performance: Evidence from unexpected externalities in China. *Social Science Electronic Publishing*, *5*(1), 2–49.

Jie, W., & Bin, L. (2015). Environmental regulation and enterprise productivity: Does the destination really matter? *Collected Essays on Finance & Economics*, *29*(9), 1575–1587.

Jin, W., Zhang, H-q., Liu, S-s., & Zhang, H-b (2019). Technological innovation, environmental regulation, and green total factor efficiency of industrial water resources. *Journal of Cleaner Production*, *211*, 61–69. https://doi.org/10.1016/j.jclepro.2018.11.172

Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica*, *50*(3), 649–670. https://doi.org/10.2307/1912606

Kim, W. C., & Mauborgne, R. (1998). Value innovation: The strategic logic of high growth. *Harvard Business Review*, *75*(1), 102–112.

Kim, Y., Tanaka, K., & Ge, C. (2018). Estimating the provincial environmental Kuznets curve in China: A geographically weighted regression approach. *Stochastic Environmental Research and Risk Assessment*, *32*(7), 2147–2163. https://doi.org/10.1007/s00477-017-1503-z

Liao, X., & Shi, X. (2018). Public appeal, environmental regulation and green investment: Evidence from China. *Energy Policy*, *119*, 554–562. https://doi.org/10.1016/j.enpol.2018.05.020

Lu, Y., Wu, M., & Yu, L. (2012). Is there a pollution haven effect? Evidence from a natural experiment in China. *MPRA Paper*, *3*(6), 249–275.

Manuel, F., Jens, H., & Klaus, R. (2007). End—of—pipe or cleaner production? An empirical comparison of environmental innovation decisions across OECD countries. *Business Strategy and the Environment*, *8*, 571–584.

Mao, Q., & Sheng, B. (2017). The impact of tariff reductions on firm dynamics and productivity in China: Does market-oriented transition matter? *China Economic Review*, *45*, 168–194. https://doi.org/10.1016/j.chieco.2017.07.011

Pang, R., Zheng, D., Shi, M., & Zhang, X. (2019). Pollute first, control later? Exploring the economic threshold of effective environmental regulation in China's context. *Journal of Environmental Management*, *248*(1), 109275–109275. https://doi.org/10.1016/j.jenvman.2019.109275

Porter, M. E., & Linde, C. V. (1995). Toward a new conception of the environment competitiveness relationship. *Journal of Economic Perspectives*, *9*(4), 97–118. https://doi.org/10.1257/jep.9.4.97

Rassier, D. G., & Earnhart, D. (2010). The effect of clean water regulation on profitability: Testing the Porter hypothesis. *Land Economics*, *86*(2), 329–344. https://doi.org/10.3368/le.86.2.329

Rosenbaum, P. R., & Rubin, D. B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician*, *39*(1), 33–38.

Rubashkina, Y., Galeotti, M., & Verdolini, E. (2015). Environmental regulation and competitiveness: Empirical evidence on the Porter Hypothesis from European manufacturing sectors. *Energy Policy*, *83*, 288–300. https://doi.org/10.1016/j.enpol.2015.02.014

Shao, S., Yang, Z., Yang, L., & Ma, S. (2019). Can China's energy intensity constraint policy promote total factor energy efficiency? Evidence from the industrial sector. *The Energy Journal*, *40*(4), 101–130. https://doi.org/10.5547/01956574.40.4.ssha

Škare, M., Soriano, D. R., & Porada-Rochoń, M. (2021). Impact of COVID-19 on the travel and tourism industry. *Technological Forecasting and Social Change*, *163*, 120469. https://doi.org/10.1016/j.techfore.2020.120469

Stjepanovic, S., Tomic, D., & Skare, M. (2022). A new database on Green GDP; 1970–2019: A framework for assessing the green economy. *Oeconomia Copernicana*, *13*(4), 949–975. https://doi.org/10.24136/oc.2022.027

Su, C. W., Chen, Y., Hu, J., Chang, T., & Muhammad, U. (2022b). Can the green bond market enter a new era under the fluctuation of oil price?, *Economic Research—Ekonomska Istrazivanja*, Published online.

Sun, W., Yang, Q., & Ni, Q. (2019). The impact of environmental regulation on employment: An empirical study of China's two control zone policy. *Environmental Science and Pollution Research*, *26*, 26472–26487.

Su, C.-W., Wang, K.-H., Tao, R., & Lobonţ, O.-R. (2019a). Does the covered interest rate parity fit for China? *Economic Research-Ekonomska Istraživanja*, *32*(1), 2009–2027. https://doi.org/10.1080/1331677X.2019.1642780

Su, C.-W., Wang, K.-H., Zhang, H.-G., & Nian, R. (2019b). Can onshore spot market progress influence offshore NDF market development for the CNY? *Economic Research-Ekonomska Istraživanja*, *32*(1), 1621–1644. https://doi.org/10.1080/1331677X.2019.1636697

Su, C. W., Xi, Y., Muhammad, U., & Chang, T. (2022a). Is presidential popularity a threat or encouragement for investors? *Economic Research—Ekonomska Istraživanja*, Published online.

The 2018 Bulletin on the state of China's Ecological Environment. http://www.mee.gov.cn/

The 2019 BP Statistical Review of World Energy (BP). (2019). https://blog.alfaenergygroup.com

Titah, R., Shuraida, S., & Rekik, Y. (2016). Integration breach: Investigating the effect of internal and external information sharing and coordination on firm profit. *International Journal of Production Economics*, *181*, 34–47. https://doi.org/10.1016/j.ijpe.2016.01.002

Wang, K. H., Liu, L., Zhong, Y., & Oana-Ramona, L. (2022a). Economic policy uncertainty and the carbon emission trading market: A Chinese perspective. *Energy Economics*, *115*, 106342. https://doi.org/10.1016/j.eneco.2022.106342

Wang, Y., & Shen, N. (2016). Environmental regulation and environmental productivity: The case of China. *Renewable and Sustainable Energy Reviews*, *62*, 758–766. https://doi.org/10.1016/j.rser.2016.05.048

Wang, K. H., Su, C. W., & Tao, R. (2019a). Time-varying character for short-term capital flow from the interest rate aspect in China. *Economic Research-Ekonomska Istraživanja*, *32*(1), 2761–2779. https://doi.org/10.1080/1331677X.2019.1655657

Wang, K.-H., Su, C.-W., Tao, R., & Xiong, D.-P. (2019b). Does the purchasing power parity fit for China? *Economic Research-Ekonomska Istraživanja*, *32*(1), 2028–2043. https://doi.org/10.1080/1331677X.2019.1637763

Wang, X., Xu, Z., Qin, Y &., & Skare, M. (2022). Innovation, the knowledge economy, and green growth: Is knowledge-intensive growth really environmentally friendly? *Energy Economics*, *115*, 106331. https://doi.org/10.1016/j.eneco.2022.106331

Wang, K. H., Zhao, Y. X., Jiang, C. F., & Li, Z. Z. (2022b). Does green finance inspire sustainable development? Evidence from a global perspective. *Economic Analysis and Policy*, *75*, 412–426. https://doi.org/10.1016/j.eap.2022.06.002

Xie, R. H., Yuan, Y. J., & Huang, J. J. (2017). Different types of environmental regulations and heterogeneous influence on "green" productivity: Evidence from China. *Ecological Economics*, *132*, 104–112. https://doi.org/10.1016/j.ecolecon.2016.10.019

Xu, J. (2012). Profitability and capital structure: evidence from import penetration. *Journal of Financial Economics*, *106*(2), 427–446. https://doi.org/10.1016/j.jfineco.2012.05.015

Yang, Q., Geng, Y., Dong, H., Zhang, J., Yu, X., Sun, L., Lu, X., & Chen, Y. (2017). Effect of environmental regulations on China's graphite export. *Journal of Cleaner Production*, *161*, 327–334. https://doi.org/10.1016/j.jclepro.2017.05.131

Yang, Z., Xiong, Z., Xue, W., & Zhou, Y. (2022). The impact of pollution fee reform on the emission of water pollutants: evidence from manufacturing enterprises in China. *International Journal of Environmental Research and Public Health*, *19*(17), 10660. https://doi.org/10.3390/ijerph191710660

Zeng, S. X., Meng, X. H., Yin, H. T., Tam, C. M., & Sun, L. (2010). Impact of cleaner production on business performance. *Journal of Cleaner Production*, *18*(10-11), 975–983. https://doi.org/10.1016/j.jclepro.2010.02.019

Zhang, C., Liu, H., Bressers, H. T., & Buchanan, K. S. (2011). Productivity growth and environmental regulations – Accounting for undesirable outputs: Analysis of Chinas' thirty provincial regions using the Malmquist–Luenberger index. *Ecological Economics*, *70*(12), 2369–2379. https://doi.org/10.1016/j.ecolecon.2011.07.019

Zhang, D., Wang, Y., & Jiao, Y. (2022b). The impact of social pension schemes on the mental health of the Chinese elderly: A mediating effect perspective of two-way intergenerational support. *International Journal of Environmental Research and Public Health*, *19*(14), 8721. https://doi.org/10.3390/ijerph19148721

Zhang, Q., Yu, Z., & Kong, D. (2019). The real effect of legal institutions: Environmental courts and firm environmental protection expenditure. *Journal of Environmental Economics and Management*, *98*, 102254–102254. https://doi.org/10.1016/j.jeem.2019.102254

Zhang, D., Zhang, G., Jiao, Y., Wang, Y., & Wang, P. (2022a). "Digital dividend" or "digital divide": What role does the internet play in the health inequalities among Chinese residents? *International Journal of Environmental Research and Public Health*, *19*(22), 15162. https://doi.org/10.3390/ijerph192215162

Zhou, G., Liu, W., & Zhang, L. (2019). Can environmental regulation flexibility explain the porter hypothesis?—An empirical study based on the data of China's listed enterprises. *Sustainability*, *11*(8), 2214.

Zingales, L. (1998). Survival of the fittest or the fattest? Exit and financing in the trucking industry. *The Journal of Finance*, *53*(3), 905–938. https://doi.org/10.1111/0022-1082.00039