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Impact of Regional Environmental Regulations on Taiwanese Investment in Mainland China

Fang Yang and Qinfan Gan *

Graduate Institute for Taiwan Studies, Xiamen University, Xiamen 361005, China; yangfang@xmu.edu.cn
* Correspondence: qinfangan@stu.xmu.edu.cn

Abstract: Based on the perspective of regional differences and decentralization, this article investigated the impact of environmental regulations on Taiwanese investment in mainland China from theoretical and empirical perspectives, and analyzed whether local governments are competing to lower environmental standards to attract Taiwanese investment so as to maintain their comparative advantages. This paper constructed a theoretical model through a two-stage game model. With the panel data of each province in Mainland China from 2006 to 2016, the theoretical propositions were empirically tested through the system GMM estimation method. The results show that the environmental regulation policies adopted by the local governments in the mainland have a significant inhibitory effect on the investment volume of Taiwan-funded enterprises, and the interaction between environmental regulations and local tax burden levels also has a negative effect on Taiwanese investment. Local governments have the motive to reduce environmental regulations to attract investment.

Keywords: environmental regulation; Taiwanese investment in mainland China; system GMM

Citation: Yang, F.; Gan, Q. Impact of Regional Environmental Regulations on Taiwanese Investment in Mainland China. *Sustainability* **2021**, *13*, 4134. https://doi.org/10.3390/su13084134

Academic Editors: Marc A. Rosen, Roberto Zoboli, Massimiliano Mazzanti and Simone Tagliapietra

Received: 15 December 2020
Accepted: 28 March 2021
Published: 8 April 2021

1. Introduction

Since Taiwanese-invested enterprises invested in the mainland of China in the late 1980s, the vast market potential, cheap labor costs, and leap-forward development of the infrastructure in the mainland have been favored by Taiwanese-invested enterprises. Taiwanese-invested enterprises have gradually become important promoters for the mainland of China to undertake international industrial transfers. At the end of 2019, the mainland had approved a total of 112,442 Taiwanese-invested projects. At present, nearly 70–80% of Taiwan's listed (counter) companies and tens of thousands of Taiwanese small and medium-sized enterprises and freelancers operate in the mainland. As the mainland's economy enters a new normal, the demographic dividend is gradually disappearing, and the environmental carrying capacity continues to weaken. The mainland's inspection standards for Taiwanese-invested enterprises have become increasingly strict, which undoubtedly puts forward higher requirements for Taiwanese-invested enterprises that are mainly concentrated in manufacturing industries. As a result, Taiwanese-funded enterprises need to reconstruct investment strategies, change business strategy models, and adjust industrial layout. Thus, since the reform and opening up, whether the goal of economic catch-up will prompt local governments to lower environmental standards so as to attract Taiwanese enterprises is an issue that needs to be studied in the current development of a green economy.

According to the *2020 Research Report on China's Top 500 in Foreign Trade*, among the top 100 Chinese mainland export companies in 2019, 32 were Taiwanese-invested enterprises, contributing to more than 40% of the total exports. The development and upgrading of Taiwanese-invested enterprises in the mainland is of great significance to the economic development and industrial structure optimization of the mainland. Taiwanese investment in mainland China is mostly concentrated in manufacturing (more than 50%). Although the proportion of Taiwanese investment in manufacturing has declined in recent

years, it was still as high as 73.5% in 2016. Moreover, in the manufacturing industry, high-energy-consuming industries such as electronic component manufacturing, chemical material manufacturing, paper product manufacturing, and nonmetallic mineral product manufacturing account for more than 70%, please refer to Appendix A (Nie Pingxiang, 2017) [1]. Different from the foreign investments, which mainly focus on setting up offices or R&D centers in the mainland, Taiwanese investment is dominated by heavily polluting foundry enterprises, which need lots of land to build factories. Taiwanese businessmen are therefore more affected by the environmental regulations of mainland China than foreign businessmen. Taiwanese-invested enterprises are increasingly affected by the mainland's differential environmental regulations. Taking the Taiwanese Investment Zone in Kunshan as an example, in an environment remediation action carried out by the Kunshan government in September 2007, nearly two hundred Taiwanese-invested companies were shut down due to serious pollution emissions. Following up Kunshan, more than a dozen Taiwanese-invested enterprises in Zhuhai were required to limit production and emissions for three days due to air pollution restrictions. In recent years, Taiwanese businesses have faced multiple challenges in the mainland, including rising operating costs and stringent new environmental regulations, according to the *2017 Report on the Investment Environment and Risk Survey in Mainland China* published by the Taiwan Electrical and Electronic Industry Trade Union at the end of September 2017.

In the past 40 years, on the one hand, Taiwan's investment in the mainland has had obvious regional differences; on the other hand, due to the differences in natural conditions and regional economic development between provinces and regions of provinces in mainland China, the level of economic development and environmental regulations have also shown a significant difference, please refer to Appendix B. Is the change in the distribution of Taiwanese-invested enterprises on the mainland related to regional differences in environmental regulations? Are regional differences in environmental laws and regulations one of the important driving factors for Taiwan's investment to move westward? These two issues are the focus of this article.

The literature review of this article covers two aspects. The first is about the impact of environmental regulations on the choice of investment location. The impact of environmental regulations on the location of Foreign direct investment is a hot issue in the international and environmental economics circles. Long and Siebert [2] incorporated environmental variables into the neoclassical general equilibrium model and found that environmental regulations affect the investment layout of enterprises through production cost channels. Levinson [3] pointed out that environmental regulations will drive companies to move to countries or regions with loose environmental regulations. John and Catherine [4] used sample data to analyze the impact of environmental regulations on FDI in various US states. Xing and Kolstad [5] found that loose environmental regulations are an important factor in attracting the transfer of pollution-intensive industries in the United States. The second is about research on the impact of environmental regulations on enterprises. It is generally believed that environmental regulations can affect the production and operating costs of enterprises by requiring enterprises to purchase pollution control equipment and technologies, restricting the location of and the method for pollution discharge, and restricting the combination of input and output elements in the production process (Xing and Kolstad, 2002) [5]. Moreover, as the impact of environmental regulations on standardizing corporate behaviors gradually increases, corporate performance will be further affected by environmental regulations. Based on the static analysis framework of the perfect competitive market of neoclassical economics, some scholars have studied and analyzed that strict environmental regulations will inevitably affect the profitability of enterprises and raise the barriers to entry of foreign capital. In order to avoid stringent environmental regulatory standards, companies will choose regions with looser environmental regulations to invest in so that they can maintain their market competitiveness and maximize benefits. Some scholars have also focused their research on the impact of environmental regulations on the total factor productivity of enterprises. Appropriate environmental regulations

are not only conducive to improving the total factor productivity of enterprises, but this positive impact can effectively alleviate the negative effects of environmental regulations on the survival time of enterprises. Popp and Newell [6] pointed out that environmentally friendly technological advancements brought about by environmental regulations cannot offset all required losses of productivity.

This article attempted to use Taiwanese-funded enterprises as a research sample to explore the impact of environmental regulation on investment. Overall, the industries invested by Taiwan-funded enterprises in the mainland are dominated by manufacturing, and those industries with high pollution and high emissions account for a relatively large proportion. From a certain perspective, while providing Taiwan-funded enterprises with abundant production factors, the mainland has also undertaken a large number of high-pollution and high-emission industries in Taiwan. As the mainland enters a new stage in economy, on the one hand, how the mainland has shifted from the extensive growth model at the expense of the environment to the intensive green growth model with low energy consumption is an important path for the economy to shift to high-quality development, and local governments need to adopt corresponding measures, such as environmental regulation and other policies; on the other hand, due to the institutional characteristics of "decentralized governance" in the mainland, the central government and local governments often have certain differences in the implementation of environmental policies. The central government prefers to support low-carbon emission industries to implement sustainable development strategies, while local governments will compete by lowering regional environmental regulatory standards so as to attract more foreign investment, resulting in disrupted market mechanisms and causing environmental degradation (Ollivier, 2016; Fischer and Springborn, 2011) [7,8]. This provides a great possibility for local governments to independently adjust the implementation of environmental regulations.

Based on the above analysis, this article analyzed the "bottom-to-bottom effect" of environmental regulations and local governments introducing Taiwan-funded enterprise investment from both theoretical and empirical aspects. Specifically, a two-stage game model is first used to examine the interaction between provincial environmental regulations and Taiwan-funded enterprises, and to obtain theoretical propositions about provincial environmental regulations and the investment level of Taiwan-funded enterprises. Secondly, environmental regulations are introduced into the gravity model based on panel data composed of 23 provinces in mainland China from 2006 to 2016. Subsequently, detailed research conclusions are drawn by empirically testing the impact of environmental regulations on Taiwanese investment in mainland China and the investment potential of different regions.

2. Theoretical Analysis and Research Hypotheses

Mainland China has a vast territory, and the market environment, institutional quality, and cultural history vary in different regions. The bottom-line effect of environmental regulations on Taiwan-funded enterprises' investment is also difficult to show due to the homogeneous distribution among local governments. In local governments, environmental supervision is the most effective policy to promote the trade-off between investment and environmental protection. While some local governments are urging enterprises to accelerate the improvement of pollution control capacity and technological innovation through environmental regulations, and strengthen the improvement of environmental quality within their jurisdictions, in order to increase the intensity of investment promotion, there are also local governments competing by viciously lowering environmental regulatory standards. Improving performance evaluation during the tenure has led to the phenomenon whereby the implementation of environmental policies by the central and local governments often run counter to each other, which ultimately leads to differences in the effect of policy-driven changes in enterprises. The relocation of the Xiamen PX project to Gulei, Zhangzhou in 2007 is a typical case. This project was invested in by Taiwanese-funded enterprise Tenglong Aromatics (Xiamen, China) Co., Ltd. The original plan was to

build a chemical plant with an annual output of 800,000 tons of paraxylene (PX) in Haicang District. Due to the potential for high pollution of xylene (PX), the project was jointly opposed by a hundred members of the CPPCC (Chinese People's Political Consultative Conference) and collectively resisted by citizens. Finally, the project was relocated to Gulei, Zhangzhou.

This section uses a two-stage game model to describe the game behavior of local governments and Taiwan-funded enterprises with the goal of maximizing their respective effects, thereby revealing the interactive effects of environmental regulations, regionally favorable Taiwan policies, and Taiwan-funded enterprises' output decisions. The analysis of government environmental decision-making in environmental economics literature can be traced back to Oates and Schwab (1988) and Cumberland (1979) [9,10]. The model proposed in this article draws on the imperfectly competitive market framework adopted by Barrett (1994) and other documents. The difference is that our model focuses on examining whether the local government has lowered the local environmental regulatory standards in order to attract Taiwan-funded enterprises to maximize the economic benefits of the region under the regional differences in the preferential policy for Taiwanese investment.

Given that mainland China is composed of multiple provinces (municipalities), then $i = 1, \ldots, n$. Each province (municipality) has one domestic-funded enterprise and one Taiwan-funded enterprise. Enterprises compete based on output within the region. Assuming that both domestic and Taiwan-funded enterprises produce the same product, the industry has a linear demand function $q = a - p$, where a is the market size, p is the price, and q is the output. Both the production cost and pollution control cost of an enterprise are proportional to the output. Under the above assumptions, the corporate profit functions of the i-th province (municipalities directly under the Central Government), respectively, represent:

$$\pi_i{}^d(q_i{}^d) = q_i{}^d[a_i - b(q_i{}^d + q_i{}^t)] - c_i{}^d q_i{}^d - (\theta_i{}^d - e_i)q_i{}^d,\ i = 1\ ,2,3\ldots \quad (1)$$

$$\pi_i{}^t{}_{(}q_i{}^t{}_{)=}q_i{}^t[a_i - b(q_i{}^d + q_i{}^t) - c_i{}^t q_i{}^t - (\theta_i{}^t - f(w)\cdot e_i)q_i{}^t,\ i = 1\ ,2,3\ldots \quad (2)$$

Among them, π and c represent profit and production cost per unit output, respectively. All variables with superscript d correspond to domestic-funded enterprises and all variables with superscript t are related to Taiwan-funded enterprises. $\theta \succ 0$ is emissions per unit of production, while a smaller θ means that the company has cleaner technology. w is the adjustment function of Huitai policy. Regarding the adjustment effect of the "Huitai Policy", this article uses w in the theoretical model to represent the differences in the implementation of environmental regulations in various regions. In the empirical part, the two lagging periods of taxation variables are selected to measure the differences in the institutional environment. $e \geq 0$ is the emission standard set by the local government and $f(w)\cdot e \geq 0$ is the emission standard set by the local government for Taiwan-funded enterprises. Smaller e and $f(w)\cdot e$ mean stricter environmental standards. $\theta - e$ and $\theta - f(w)\cdot e$ represent the part of each unit of output that domestic-funded enterprises and Taiwan-funded enterprises need to govern themselves. In order to make the output non-negative within the scope of any standard environmental regulation, it is necessary to assume that the market size a is sufficiently large, that is,

$$a_i \geq 2max\left\{c_i{}^d + \theta_i{}^d, c_i{}^t + \theta_i{}^t\right\}. \quad (3)$$

In this model, environmental regulation, as a policy variable, is controlled by government policies, and is an endogenous variable. The mainland's policies on environmental regulation do not distinguish domestic and Taiwan-funded enterprises, but environmental regulation policies have regional differences in the specific implementation process. That is, in order to attract more investments, local governments will give preferential treatment to Taiwan-funded enterprises. For example, after the central government of mainland China issued *Several Measures for Promoting Cross-Strait Economic and Cultural Exchanges*

and Cooperation (referred to as *31 Benefit Measures for Taiwan*) in 2018, 20 provinces and 49 cities with relatively concentrated Taiwanese-invested enterprises have successively launched specific benefit policies based on local conditions, including "Shanghai's 55 Benefit Measures for Taiwan", "Fujian's 66 Benefit Measures for Taiwan", "Jiangsu's 76 Benefit Measures for Taiwan", and "Tianjin's 52 Benefit Measures for Taiwan". Due to the different policies issued by local governments towards Taiwanese investment and the deviation in implementation, the impact of environmental regulations on domestic and Taiwan-funded enterprises may be heterogeneous.

The game process between manufacturers and local governments is divided into two stages: in the first stage, the provincial governments formulate environmental regulatory standards e_i, $i = 1, \ldots n$; in the second stage, domestic-funded enterprises and Taiwan-funded enterprises choose their own output according to local environmental standards to maximize profits. First, the enterprise regards the environmental standard e set by the government as a constant and chooses the optimal output under the condition of maximizing profit.

By deriving the output in (1) and (2), the following first-order conditions can be obtained:

$$q_i *^d (e_i) = 1/3b(M + C_i{}^t - f(w)e_i + 2e_i) \, , i = 1, 2, \ldots, n \quad (4)$$

$$q_i *^t (we_i) = 1/3b(M + \theta_i{}^d + 2f(w)e_i) \, , i = 1, 2, \ldots, n \quad (5)$$

where $M = a_i + \theta_i{}^t - 2c_i{}^d - 2\theta i^d$.

Judging from the slope of output to local environmental regulations in Equations (4) and (5), the following propositions can be obtained:

Proposition 1. *The lowered environmental regulatory standards by local governments will stimulate the production of high-polluting and high-energy-consuming enterprises.*

The implication of Proposition 1 shows that loose environmental regulations are attractive to enterprises. From the perspective of profit maximization, loose environmental regulations will reduce the pollution control costs of enterprises, thereby increasing their local investment and production.

Proposition 2. *Due to the regional differences in the strengths and implementation deviations of the local government's favorable policies towards Taiwanese investment, environmental regulations will have heterogeneous effects on Taiwanese-invested enterprises, thereby impacting the distribution of Taiwanese investment.*

Proposition 2 constitutes the main contribution of this article in examining the correlation of regional government environmental regulations and institutional environments with Taiwanese investment. Two inseparable aspects need to be considered when examining the government's use of environmental regulations to attract Taiwanese-funded enterprises. On the one hand, the inflow of investment by Taiwan-funded enterprises is negatively correlated with the intensity of environmental regulations; on the other hand, local governments are making environmental regulations. The comprehensive effect of the institutional environment will be fully considered in the standard. In order to attract Taiwan-funded enterprises, the governments of different regions will adjust the relevant policies of the institutional environment. When the comprehensive effect of the improvement of the institutional environment and environmental regulation in a certain region has a negative effect on the investment of Taiwan-funded enterprises, the local governments will also adopt competition to lower environmental regulatory standards.

3. Methods, Models, and Variables

3.1. Empirical Model Setting

Based on the above theoretical analysis, this part studies the impact of environmental regulations on Taiwanese investment in mainland China based on the Anderson and van

Wincoop's [11] gravity model analysis framework, and conducts empirical tests on the two propositions. The constructed measurement is model as follows:

$$LnTDI_{it} = \alpha + \beta_1 LnTDI_{it-1} + \beta_2 lnER_{it} + \beta_3 L_2Tax_{it} + \beta_4 lnER_{it} * L_2Tax_t + \gamma X_{it} + V_i + e_{it} \quad (6)$$

Among them, TDI_{it} represents the stock of foreign investment by Taiwanese businessmen in the i-th province (including municipalities directly under the Central Government) in year t. The statistics are from the monthly statistics of the Investment Review Committee of the Ministry of Economic Affairs of Taiwan in 2019. ER_{it} is the environmental regulations of the i-th province, L_2Tax_{it} indicates that the tax burden level lags behind the second period, and $\beta\gamma$ is the control variable. GDP_{it} is market size, Lab_{it} is labor cost, $Open_{it}$ is foreign trade dependence, Dis_{it} is geographic distance and $Infra_{it}$ is infrastructure level, α is the intercept that does not vary with the individual, β and γ are the coefficients to be estimated, μ_i is the individual effect, and ε_{it} is the random error term. Considering the availability and consistency of data, this paper selected 23 provinces (municipalities) and the sample period was established as 2006–2016.

3.2. Introduction and Description of Related Variables

Explanatory variables are the main factors that affect Taiwanese investment in mainland China. They are divided into core explanatory variables and control variables. The former includes environmental regulations, tax burden levels, and the interaction between environmental regulations and tax burden levels, and the latter includes GDP, geographic distance, labor costs, infrastructure, and foreign trade dependence.

3.2.1. Environmental Regulation (ERS)

There are no definite indicators on how to measure environmental regulations. In terms of indicator selection, in addition to the availability of data, whether the indicators themselves are relatively reasonable is also a key consideration. At present, domestic and foreign scholars mainly measure the intensity of environmental regulation from three aspects: First, from the perspective of cost, it is mainly measured from the cost of pollution control and investment expenditure. For example, Lanoie [12] used the proportion of pollution investment in the total cost of the enterprise to measure the degree to which the enterprise implements environmental regulatory standards. Second, from a performance perspective, some scholars measure it from the perspective of pollution discharge treatment compliance rate. For example, Cole and Elliott [13] used different emission densities, such as industrial wastewater rate, industrial SO_2 emission rate, and industrial solid emission rate, to calculate comprehensive environmental regulatory indicators. Some scholars have also constructed environmental regulatory indicators from the concept of unit pollution. For example, Domazlicky and Weber [14] measured the change in pollution discharge volume or pollution discharge intensity per unit output value under formal environmental regulations. Third, the number of laws and policies is used as an indicator to measure the intensity of environmental regulations.

By referring to and improving the method of Cole and Elliott [13], this paper used the carbon dioxide emissions per unit of GDP, i.e., carbon dioxide intensity, to measure the level of environmental regulation. There were three major reasons for this choice. The first reason was the availability of the data. If the environmental regulation indicators of each province (such as the indicator of total energy consumption control) are adopted, there will be missing data in some years or provinces and difficulties in data statistics. Second, in the context of a low-carbon economy, carbon intensity has become an obligatory target for the Chinese government in environmental regulation. In 2009, the Chinese government set a quantitative goal to control greenhouse gas emissions: the carbon emissions per unit of GDP are to be reduced by 40% to 45% by 2020 compared to 2005. In June 2015, Mainland China submitted the *Strengthened Actions to Address Climate Change—China's Nationally Determined Contributions* to the United Nations. This document further established the autonomous action goal of mainland China: by 2030, the carbon dioxide emissions per

unit of GDP should be reduced by 60−65% compared to 2005. Third, existing studies have shown that there is Granger causality between environmental regulations and carbon intensity, and environmental regulations play a key role in regional carbon intensity. A lower carbon intensity means stricter environmental regulations. In those provinces with stringent environmental law enforcement, environmental regulations can significantly reduce carbon emissions, and the carbon intensity per unit of pollution and the amount of pollution per capita will decline greatly, even two years after the legislation (Shen et al., 2017; Bao et al., 2013) [15,16].

The carbon dioxide emission indicators used in this article were estimated based on the *Greenhouse Gas Emission Guidelines* issued by the IPCC (2006) and the standards and methods of the Office of the National Climate Change Coordination Group and the Energy Research Institute of the National Development and Reform Commission (2007). There are mainly two sources of carbon dioxide emissions: one is carbon dioxide emissions from the combustion of fossil energy, including coal, oil, and natural gas; the other is carbon dioxide from the cement production process.

The calculation formula for the CO_2 emissions from fossil energy combustion is as follows:

$$EC = \sum_{i=1}^{6} EC_i = \sum_{i=1}^{6} E_i * EF_i. \quad (7)$$

Among them, EC is the total CO_2 emissions of various energy consumption; i is energy types, including coal, gasoline, kerosene, diesel, fuel oil and natural gas; and E_i is the total consumption of various energy sources by province. EF_i is the CO_2 emissions coefficient.

The CO_2 emissions from the cement production process are calculated as follow:

$$CC = Q \times EF_{cement}. \quad (8)$$

CC is the CO_2 emission coefficient during cement production, Q represents the total cement production, and EF_{cement} represents the CO_2 emission coefficient for cement production. The consumption data of coal, oil, natural gas, and other energy sources, as well as the reference coefficients for converting each energy into standard coal, are all from the *China Energy Statistical Yearbook*, and the cement production data are from the CEIC China Economic Database. The CO_2 emission coefficients of coal, gasoline, kerosene, diesel, fuel oil, and other fossil fuel combustions are 1.776, 3.045, 3.174, 3.15, and 3.064, respectively; the CO^2 emission coefficients of natural gas and cement in the industrial production process are 2.167 and 0.527, respectively.

3.2.2. Control Variables

According to the characteristics of Taiwanese investment in mainland China, this article selected the following control variables:

According to the investment gravity model, the total amount of investment between two places is positively correlated with the economic scales of the two places, but negatively correlated with the distance between them. (1) Market size: Taiwan is an economy with a small market size. The regions long favored by Taiwanese-invested enterprises, such as mainland China, Southeast Asia, and the United States, have a huge market size, which is an important factor behind the location choice of Taiwanese-invested enterprises. In this paper, the GDP of each province was used to represent the potential market size and investment demand in Mainland China. (2) Distance cost (Dis): Taiwanese investment is mostly concentrated in the eastern coastal regions, and geographical proximity is an important factor as it means lower transportation costs. This article used actual geographic distance to measure, that is, as the geographic distance between the two sides of the strait gradually narrows, the flow of investment across the strait gradually increases. (3) Labor cost (Lab): Taiwanese investment in the mainland is mainly concentrated in foundry enterprises. These enterprises adopt a development mode of receiving orders from Taiwan, processing and manufacturing in the mainland, and selling products to overseas markets

such as Europe and the United States. Enterprises with this business model are labor-intensive, and labor cost is an important factor in their location selection. In order to reflect the regional labor cost, this paper adopted the average wage of urban employees as a measure of labor cost. The higher the average wage of urban employees, the higher the average labor cost in the region. (4) Tax burden level (Tax): Preferential tax policies are more attractive to Taiwanese businessmen's direct investment in the mainland, and they play an important role in promoting cross-strait integration. This article used the proportion of local fiscal tax revenue in the current year's GDP to measure the level of tax burden in the general budget revenue of local fiscal revenues, and analyzes the effect of environmental regulations and tax burdens on Taiwan's direct investment in mainland China, taking into account the time lag of tax policy. The time lag of taxation is due to the fact that the transmission process of policy information itself takes a certain amount of time, and on the other hand, it is also due to the rigidity of economic operation itself. In the empirical process, this paper adopted the current period of tax burden, the first period, and the second period, but the current level and the first period are not significant. Due to space reasons, they are not listed in the main text. That is to say, the time difference between the implementation of the tax policy and the effect of the relevant economic entities' behaviors to produce the expected economic effect, the second period of the tax burden level has been selected as the proxy indicator of the tax burden level. (5) Infrastructure (Infra): A sound infrastructure is a factor investors must consider while choosing an investment place, because it is conducive to the agglomeration and diffusion of labor and other production factors, thus realizing the complementary advantages of production factors and resources. This article divides the total length of roads and railways by the total size of the region to measure the level of infrastructure construction in a region. (6) Openness (Open): Taiwanese-invested enterprises rely mainly on OEM production and their products are mostly sold to overseas markets. Thus, the level of regional openness is also a factor to be considered in the location selection of Taiwanese investment. This article used total import and export divided by GDP to measure the level of opening up. The source of the above data was the China Statistical Yearbook. The descriptive statistics of specific variables are shown in Table 1.

Table 1. Descriptive statistics of main variables.

Variable	Description	Observations	Mean	Standard Deviation	Minimum	Max
lnTDI	Taiwanese investment stock	253	13.878	1.831	9.7	17.75
lnERS	Strength of environmental regulations	253	0.598	0.439	−0.52	1.845
L2.Tax	Tax level	207	0.097	0.031	0.054	0.194
lnGDP	The level of economic development	253	9.703	0.694	7.745	11.343
lnLab	labor cost	253	10.575	0.456	9.628	11.737
lnDis	Geographic distance	253	13.999	0.517	12.431	14.667
lninfra	Infrastructure level	253	−0.294	0.744	−2.574	0.74
Open	Degree of openness	253	−1.563	1.048	−3.937	0.543

4. Analysis of Empirical Result

4.1. Empirical Test and Result Analysis

The methodology of this paper was based on the system GMM model for conducting empirical testing on the data of 23 provinces (municipalities) in mainland China from 2006 to 2016. First, the natural logarithm method was used to control the heteroscedasticity problem to a large extent. Second, the VIF (variance inflation factor) value was less than 10, which shows that there was no system multicollinearity problem among variables.

Taking into account the possible continuity of Taiwanese investment in the mainland, the current Taiwanese investment is likely to be affected by the amount of investment in the previous period. This article introduced the lagging period of Taiwanese investment into the model as an explanatory variable. This term is easily correlated with the error term. When the explanatory variable has endogeneity, both the fixed effect and random effect models may lead to estimation bias. Therefore, this paper adopted the system GMM method for estimation, and adopted the lagged second phase value of the explained variable as the instrumental variable. The system GMM method can use the difference equation and the level equation at the same time, so the instrumental variables are effective. The advantages of the system GMM estimation method are as follows: First, the problem of the time-invariant missing variables that affect the distribution of Taiwanese investment can be well resolved. Second, when estimating the endogenous variables of the model, the use of instrumental variables will ensure the estimation coefficients are consistent. Third, even if there are measurement errors, the use of instrumental variables will yield consistent estimates. Therefore, this paper used the system GMM method to estimate the equation.

The use of system GMM estimation methods needs to test the validity of instrumental variables. Arellano and Bover and Blundell and Bond proposed two statistical testing methods to test whether the instrumental variables of the system GMM method are effective. The first method is to use Arellano–Bond's autocorrelation (AR test) method to test whether the residuals in the difference equation have various orders of autocorrelation. In the AR test, the residual term is allowed to have first-order serial correlation, but not allowed to have second-order serial correlation. The second method is the Hansen overidentification test, which judges whether the moment conditional instrumental variables used in the estimation process are effective in general. The original hypothesis was that the instrumental variables are jointly effective.

According to the discussion of the previous estimation methods, it is believed that the system GMM estimation results are robust and reliable. The reasons are as follows: First, from the validity test results of the instrumental variables, the Hansen test cannot reject the null hypothesis that the instrumental variables are valid, which means that in the system GMM estimation, both the instrumental variables of the level equation and the difference equation are valid. Second, the results of Arellano–Bond statistic AR (2) show that there is no second-order serial correlation in the residuals of the first-order difference equation. It is therefore concluded that the instrumental variables are generally effective, and the estimated results of the system GMM are more reliable and robust. The estimated results of the system GMM in Table 2 will be analyzed below.

Analysis of the Impact of Environmental Regulations on Taiwanese Direct Investment in Mainland China

It can be seen from Table 2 that models (2)–(4) are the regression results of environmental regulations, tax burden levels, and their cross-terms on Taiwanese direct investment in mainland China. From the results of model (2), it can be seen that the coefficient of environmental regulation was significantly positive at the 5% level, indicating that when the intensity of environmental regulation is low, Taiwan-funded enterprises will increase investment or expand reproduction in pursuit of high profits. Regulations are an important institutional threshold for foreign-funded enterprises, which can screen the entry of polluting Taiwan-funded enterprises. On the one hand, the intensity of environmental regulations will force a small number of polluting Taiwan-funded enterprises to withdraw from production, or some Taiwan-funded enterprises will voluntarily withdraw from production due to high environmental governance costs. On the other hand, the remaining Taiwan-funded enterprises generally have larger scales. These Taiwanese companies will inevitably increase investment in environmental protection equipment, support for R&D and innovation, and the transformation of production methods in order to comply with the requirements of mainland environmental regulations. This will undoubtedly accelerate the transformation and upgrading of Taiwan-funded enterprises in the region. It can be seen from Model (3) that the level of tax burden in mainland China is not a key factor for

Taiwanese investment in the mainland. Preferential tax policy is an important but not a decisive factor in attracting foreign investment. The change in the income tax rate has not inhibited the launching of Taiwanese capital into the mainland. Two important factors behind the increasingly expanding scale of Taiwanese investment in the mainland are the vast market and relatively low labor costs. Moreover, mainland China in 2008 promulgated the *Enterprise Income Tax Law of the People's Republic of China* and the *Regulations for the Implementation of the Enterprise Income Tax Law of the People's Republic of China* to integrate the income taxes of domestic and foreign enterprises into one, which eliminated the tax incentives for foreign-invested enterprises, including Taiwan-funded enterprises. Taiwan-funded enterprises and domestic enterprises began to enjoy the same treatment in income tax, and the tax incentives for Taiwanese-invested enterprises no longer exist. Thereafter, Taiwan-funded enterprises, which are mostly manufacturing factories, started to pay more attention to changes in labor cost and other production factors (Chen, 2012) [17].

Table 2. The impact of environmental regulations on mainland Taiwanese investment.

		System GMM			OLS
Variables and Constants	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**
$lnTDI_{t-1}$	0.779 *** (0.024)	0.583 *** (0.096)	0.635 *** (0.080)	0.657 *** (0.091)	0.96 2*** (0.014)
lnERS		0.609 ** (0.234)	0.606 ** (0.206)	0.813 ** (0.414)	0.201 * (0.114)
L2.Tax			−1.043 (2.687)	−0.011 (2.709)	−1.135 (0.870)
lnERS*L2.Taxt				−3.832 * (2.266)	0.179 * (0.097)
lnGDP	0.101 ** (0.043)	0.544 *** (0.132)	0.499 ** (0.226)	0.408 ** (0.141)	0.069 ** (0.034)
lnLab	0.040 (0.067)	0.264 (0.195)	0.254 (0.242)	0.159 (0.261)	0.033 (0.030)
lnDis	−0.201 ** (0.069)	−0.389 ** (0.187)	−0.348 ** (0.161)	−0.449 ** (0.213)	−0.158 ** (0.079)
lnInfra	0.194 *** (0.028)	0.403 ** (0.131)	0.349* (0.181)	0.363 ** (0.154)	0.053 ** (0.018)
Open	0.119 *** (0.020)	0.311 *** (0.057)	0.283 *** (0.049)	0.167 ** (0.067)	0.07 (0.043)
constant	4.857 *** (0.875)	3.492 (3.100)	2.790 (3.271)	5.610 (4.717)	2.403 (0.905)
controls	YES	YES	YES	YES	
n	230	230	230	230	
R^2 (Adjusted R^2)					0.9929
AR(1)Test value	−2.65 **	−2.11 **	−2.18 **	−2.13 **	
AR(2)Test value	0.575	0.564	0.412	0.430	
Hansen test *p* value	0.953	0.918	0.945	0.995	

Note: 1. This table shows the estimated results of the two-step system GMM. The standard deviations in parentheses, and the symbols ***, **, and * indicate that the variable passed significance test at the levels of 1%, 5%, and 10%. 2. Arellano–Bond AR(1) test and Arellano–Bond AR(2) test represent the first-order and second-order serial correlation tests of residuals, respectively; Hansen tests are about the validity test of instrumental variables. The original hypothesis was that the instrumental variables are valid. This is represented by the *p*-value of the statistic.

In order to test the compound effect of environmental regulation and tax burden level on Taiwanese enterprises, the interaction term of environmental regulation and tax

burden level was introduced in model (4) to further test the robustness of the model. The statistical results show that environmental regulation was still significantly positive at the 5% level, and the interaction between environmental regulation and tax burden level was significantly negative, which has a significant compound effect on Taiwanese investment in mainland China. A comparison of the OLS regression results and the system GMM regression results shows that the regression results were robust. This time, the regression coefficient of the interaction term between environmental regulation and tax burden level was 0.813, which was larger than the coefficients of models (2) and (3), and was significant at the 5% level. This shows that under the same environmental regulation intensity, the higher the tax burden level in a region, the more significant the inhibitory effect of environmental regulations on Taiwanese direct investment. This means that local governments can reduce the inhibitory effect of environmental regulations on Taiwanese investment by reducing taxes and providing other preferential policies while attracting investment.

Among the control variables, GDP has a significant positive impact on Taiwanese investment, and geographical distance has a significant negative impact on Taiwanese direct investment, which conforms to the basic setting of the traditional gravity model, indicating that the market size is more attractive to Taiwanese investment. Compared with regions that are far away, Taiwanese businessmen prefer to invest in provinces (municipalities) that are closer to their geographical location. Taiwan is a small and densely populated island with a small domestic demand market and poor natural resources. It is a small economy that is heavily dependent on external markets. The mainland's coastal regions, which have a large market and are separated from Taiwan by the water, are the first choice for Taiwanese investment.

The coefficient of wage cost was not significant and the sign was positive. This cannot be interpreted as cheap labor no longer being one of the factors that attract Taiwanese investment. In fact, the current regional wage disparity in the mainland not only reflects the differences in labor costs, but also the differences in living costs and labor skills caused by various price levels in different regions. Since 2006, Taiwanese investment in the mainland has been in a stage of transformation and upgrading, and the scale of investment in high-tech and high value-added industries has gradually increased. These industries generally choose regions with concentrated talents, mature markets, and complete supporting facilities. Those regions are precisely the regions where prices are relatively high and wages are relatively high. The degree of openness and infrastructure are significantly positive, indicating that the degree of infrastructure perfection and the degree of integration into international subprojects are both key factors behind the location selection of Taiwanese investment. There are obvious regional differences in the level of infrastructure in the mainland. The high-speed kilometers and railway density in coastal and economically developed regions are significantly higher than those in the central and western regions. The degree of infrastructure perfection has always been one of the key factors for attracting Taiwanese investment. In the process of strengthening economic and trade exchanges with countries and regions around the world, and actively integrating into the global value chain, Taiwanese businessmen pay more attention to the degree of openness of investment regions. International factors have gradually become an important reference for Taiwanese businessmen to invest in the mainland and for the transformation and upgrading of Taiwan-funded enterprises.

4.2. Empirical Test Based on Spatial Heterogeneity

The mainland of the motherland has a vast territory, so the industrial structure and layout, the government's investment promotion policies, and the level of environmental regulations all have large spatial heterogeneity. Limited to the difference between the location and the national development policy, the distribution of Taiwanese investment in the mainland is different in different regions. Specifically, Taiwanese investment is more concentrated in the eastern region than in the central and western regions. Therefore,

there may also be regional differences in the impact of environmental regulations on Taiwanese investment. To this end, this article further explored the possible impact of spatial heterogeneity on the investment of Taiwanese businessmen from the coastal and inland regions. Refer to Table 3 for empirical results.The coastal regions include Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi Zhuang Autonomous Region, and the inland regions include Shanxi, Inner Mongolia, Jilin, Heilongjiang Province, Anhui Province, Jiangxi Province, Henan Province, Hubei Province, Hunan Province, Sichuan Province, Guizhou Province, and Yunnan Province economic locations.

Table 3. The heterogeneous impact of environmental regulations in different regions on Taiwanese investment.

	Eastern Mainland			**Midwestern Mainland**		
Explanatory Variable and Constant Term	**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**
$lnOFDI_{t-1}$	0.866 *** (0.052)	0.757 *** (0.046)	0.894 *** (0.031)	0.754 *** (0.295)	0.854 *** (0.057)	0.857 *** (0.055)
lnERS	0.202 * (0.107)	0.273 * (0.146)	0.389 ** (0.129)	0.578 * (0.295)	0.257 ** (0.115)	0.557 (0.670)
L2. Tax		−1.373 (2.175)	−0.049 (1.149)		−2.37 (2.019)	−0.073 (0.434)
lnERS*L2.Tax			−2.382 ** (1.016)			−1.268 (6.133)
lnGDP	0.156 ** (0.071)	0.288 *** (0.078)	0.098 ** (0.048)	0.291 ** (0.110)	0.128 * (0.075)	0.184 ** (0.093)
lnLab	0.059 (0.087)	0.058 (0.185)	0.024 (0.129)	0.332 ** (0.159)	0.194 (0.169)	0.235 (0.258)
lnDis	−0.132 ** (0.055)	−0.262 ** (0.083)	−0.104 ** (0.038)	−0.384 ** (0.193)	−0.103 0.122	−0.176 ** (0.097)
lnInfra	0.022 (0.025)	0.020 (0.049)	0.046 (0.035)	0.158 * (0.088)	0.181 *** (0.036)	0.160 ** (0.059)
Open	0.134 ** (0.051)	0.185 ** (0.070)	0.106 ** (0.036)	0.223 ** (0.106)	0.091 ** (0.043)	0.174 (0.112)
constant	1.791 * (0.956)	3.774 (2.771)	1.926* (1.012)	2.767 (2.049)	0.539 (2.159)	0.237 (2.548)
controls	YES	YES	YES	YES	YES	YES
n	90	90	90	130	130	130
AR(1) test value	−2.08 **	−2.32 **	−2.01 **	−2.44 **	−2.13 **	−2.34 **
AR(2) test value	0.468	0.228	0.301	0.570	0.341	0.352
Hansen test *p* value	1.000	1.000	1.000	1.000	1.000	1.000

Note: 1. This table shows the estimated results of the two-step system GMM. The standard deviations in parentheses, and the symbols ***, **, and * respectively indicate that the variable passed significance at the level of 1%, 5%, and 10%. test.

In the eastern region as a whole, the market system is relatively complete, and the preferential tax policies for high-tech enterprises have been implemented earlier. Taiwanese businessmen are currently in the stage of transformation and upgrading. With a rising proportion of high value-added and high-tech industries, and improved infrastructure and convenient transportation, the eastern region has become a favored investment destination for Taiwanese. The regression coefficient of environmental regulation was positive and significant. The regression coefficient of the interaction term between environmental regulation and taxation on Taiwanese direct investment was also significantly negative, which once again shows that environmental regulation will inhibit Taiwanese investment

under the dual effect of tax. The level of environmental regulation in the central and western regions did not have a significant effect on Taiwanese investment, and the effect of environmental regulation and its interaction with the tax burden level was also insignificant. The main reason is that the economic development is relatively backward, the degree of marketization is low, the environmental protection mechanism is not sound, and there are fewer ways to obtain foreign capital. Local governments therefore often relax environmental regulations as they compete to attract investment.

5. Simulation Analysis of the Potential of Taiwanese Direct Investment in the Mainland

In order to thoroughly examine the investment growth potential released by environmental regulations in different regions of mainland China, and to prioritize the selection of key promotion regions and take targeted measures when Taiwanese investment resources are relatively limited, this paper designed two different schemes to simulate and analyze the impact of environmental regulations on the investment growth potential of mainland China. Among them, "Simulation Plan 1" refers to the comparison between actual values and simulated values fitted by the model to measure the growth potential of Taiwanese businessmen's investment flows in the region; "Simulation Plan 2" refers to the improvement of the region's environmental regulations to the highest level in the region and the introduction of the empirical equation obtained in the previous article to simulate the investment potential brought about by the improvement of environmental regulations, and to finally obtain the investment potential of Taiwanese businessmen in the mainland of the motherland. The two kinds of simulation results follow.

The results in Table 4 show that the southwestern region has the greatest potential for direct investment from Taiwanese businessmen in the mainland. The value-added scale of the southwestern region is 14.832 billion US dollars, accounting for 82.22%. The southwestern region is rich in natural resources. The rapid economic growth in the coming years and the huge market scale and investment potential will induce changes in the location of Taiwan-funded enterprises. What needs attention is whether local governments will ignore environmental benefits in order to attract investment and pursue economic benefits. This requires the government to proceed from long-term benefits, make full use of local resource advantages, broaden the space for economic development according to local conditions, and transform resource advantages into economic advantages. This is followed by the southern region, with a total value added of 11.52 billion U.S. dollars, accounting for 12.42%. The central region and northeastern region followed closely behind. Taiwanese investment takes the Yangtze River Delta and Fujian and Guangdong provinces as the core regions. The southern region has gathered a large number of Taiwan-funded enterprises with its strong industrial foundation and technical strength. The central region, as an important transportation hub connecting both east and west and north and south, is a central province. The hinterland has become a major opportunity for opening up and advancing the two-way opening up of east and west. With the deepening of the national regional development strategy from the eastern coast to the hinterland and the gradient transfer of coastal industries to the central and western regions, how to release the geographical and industrial advantages of the central provinces is a core issue that the central region needs to consider when attracting Taiwanese investment. As a potential transfer region for Taiwanese-funded enterprises, the northeast region not only needs to introduce Taiwanese-funded enterprises, but also needs to upgrade and cultivate enterprises to promote Taiwan-funded enterprises to achieve cleaner production and reduce pollution emissions.

Table 4. Simulation results of mainland Taiwanese investment potential.

Region	Number of Provinces *n*	Actual Value S	Simulation Solution 1				Simulation Solution 2			
			Analog Value M	D = M − S	K = D/S	T = D*N	Analog Value M	D = M − S	K = D/S	T = D*N
North region	5	84.37	72.61	−11.76	−13.93	−58.8	71.253	−13.12	−15.55	−65.6
North-east region	3	25.18	38.72	13.54	53.77	40.62	37.517	12.34	49	37.02
Huadong region	7	1017.29	1001.73	−15.56	−1.52	−108.92	984.11	−33.18	−3.26	−232.26
Central region	3	42.72	62.93	20.21	47.31	60.63	60.97	18.25	42.72	54.75
South region	3	309.17	347.57	38.4	12.42	115.2	340.87	31.7	10.25	95.1
Southwest region	4	45.096	82.18	37.08	82.22	148.32	77.69	32.59	72.26	130.36

Note: The actual value and the simulated value are calculated based on the average value of the data in the past three years from 2014 to 2016. The actual value, S; the simulated value, M; the value added, D; and the total value added, T, are all in 100 million U.S. dollars. The specific gravity K is a percentage. North region includes Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia Autonomous Region, Northeast region, Liaoning, Jilin, and Heilongjiang; the eastern region includes Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong Province; the central region includes Henan Province, Hunan Province, and Hubei Province; the southern region includes Guangdong Province and Guangxi Province; and the southwest region includes Sichuan Province, Guizhou Province, and Yunnan Province. Due to the availability of data, the northwest region was not included.

After raising the level of environmental regulation in various regions to the highest level in the region, Taiwanese investment has a significant inhibitory effect on the improvement of the level of environmental regulation in the southwestern region, southern region, central region, and northeastern region. The main reason is that compared with eastern region and northern region, these regions have lower levels of environmental regulations. The level of environmental regulation has different effects on Taiwanese investment. Taiwan-funded enterprises have different ways of obtaining resources, innovation, and management models in different regions. This may lead to different behaviors and results of Taiwan-funded enterprises' environmental regulations in different regions. When formulating environmental regulatory policies, local governments should make heterogeneous plans for Taiwan-funded enterprises, formulate corresponding policies to attract Taiwan-funded enterprises to carry out technological innovation, and guide Taiwan-funded enterprises to transform and upgrade. In short, the investment growth potential of different regions of Taiwanese direct investment in mainland China is different, and each region needs to comprehensively weigh the local environmental regulations and policies and attract investment to stimulate the growth potential of the investment field.

6. Conclusions and Policy Recommendations

This article attempted to analyze the role of regional environmental regulations in mainland China in the location choice of Taiwan-funded enterprises. The estimation results show that regional environmental regulations have a significant inhibitory impact on the investment of Taiwan-funded enterprises. The research results of this paper show that environmental regulations are a tool for the game policy of investment promotion among governments, and local governments may sacrifice environment to promote regional economic growth. This also means that in the process of attracting investment, how to avoid the excessive pursuit of short-term effects of investment while ignoring environmental benefits and high-quality economic development are worthy of in-depth study.

The conclusion of this article is that the mainland's environmental regulations have a certain restrictive effect on Taiwanese investment, which is the result of the local government's "lowering effect" out of attracting investment. This is consistent with the research conclusions of other scholars such as Zhu Pingfang, Zhang Zhengyu, and Jiang Guolin, Zhang cai yun and Chen chen [18,19] on the impact of environmental regulations on FDI. However, the differences in the research conclusions of this article are as follows: First, in the empirical part, this paper investigated the heterogeneous impact of the different "benefit-Taiwan policies" in the eastern, central, and western regions on the environmental regulation effect. It was found that the regression coefficient of environmental regulations in the eastern region as a whole was positive, and the level of environmental regulations in the central and western regions had no significant impact on Taiwanese investment.

This shows that due to the differences in regional "benefit Taiwan policies", environmental regulations have a heterogeneous impact on the impact of Taiwanese investment. Second, with regard to the impact of the tax environment, the tax environment is a factor that cannot be ignored by foreign investment, but it has no significant impact on the overall Taiwanese investment, and its interaction with environmental regulations has regional heterogeneity. The regression coefficient of the interaction between environmental regulation and tax on Taiwanese direct investment was significantly negative in the eastern region, while the interaction between environmental regulation and tax level in the central and western regions was quite small.

The research in this article has reference value for the formulation and implementation of environmental policies and preferential policies for Taiwanese investment. Changes in environmental regulations have regional differences in the impact of Taiwan-funded enterprises' investment in mainland China, and the inhibitory effects of environmental regulations on the entry of Taiwan-funded enterprises and differences in environmental implementation are different. Based on the economic performance of the region, local governments have the motivation to lower environmental regulatory standards to absorb investment from Taiwan-funded enterprises. In the face of increasingly stringent environmental regulations on the mainland, how to promote Taiwan-funded enterprises to take root in the mainland will be an issue that needs to be considered in future policy formulation to benefit Taiwan. Environmental regulation is of great significance at the policy level to "screen" and "allocate" investment from Taiwan-funded enterprises.

The mainland has a vast territory, the level of regional economic development is quite different, and the degree of influence of regional environmental regulations on Taiwanese investment is also different. All regions need to choose appropriate environmental regulatory policies based on actual conditions. For eastern regions, on the one hand, it is necessary to more actively introduce technology-intensive, Taiwan-funded enterprises with environmental protection technology advantages, and at the same time, to further restrict and guide the transformation and upgrading of high-energy-consuming and labor-intensive Taiwan-funded enterprises; in the process of introducing Taiwan-funded enterprises in the central and western regions, apart from taking advantage of local resource endowments and actively cooperating with Taiwan-funded enterprises in the development of renewable energy projects such as wind and solar energy, it is necessary for them to pass environmental tax subsidies and other environmental regulations. It is necessary to regulate the local development of Taiwan-funded enterprises with high pollution and energy consumption. Mainland China has successively promulgated policies to benefit Taiwan, aiming to provide Taiwan-funded enterprises with equal treatment to invest in circular economy and environmental protection projects. For Taiwan-funded enterprises in the transitional period, a sustainable development direction is given from the perspective of ecological benefits.

Author Contributions: F.Y. proposed research ideas, collected data on environmental regulation, wrote the literature review and offered policy suggestions. Q.G. constructed econometric models, performed all calculations and wrote most of the paper. All authors have read and agreed to the published version of the manuscript.

Funding: The research was funded by National Natural Science Foundation of China (Grant No. 71704148), Fundamental Research Funds for the Central Universities (Grant No. 20720191050), and a major project of the Ministry of Education Humanities and Social Sciences Key Research Base (16JJD790036).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are openly available in "China Energy Statistical Yearbook", CEIC China Economic Database and "China Statistical Yearbook".

Acknowledgments: We would like to express our sincere gratitude to the editor and anonymous referees for their insightful and constructive comments. This paper was supported by National Natural Science Foundation of China (Grant No. 71704148), Fundamental Research Funds for the Central Universities (Grant No. 20720191050), and a major project of the Ministry of Education Humanities and Social Sciences Key Research Base (16JJD790036). Especially, we would like to appreciate the experts who participated in the evaluation and improvement of this manuscript.

Conflicts of Interest: The authors declare no conflics of interest.

Appendix A

Table A1. Top Ten Industries for Taiwanese Manufacturing Investment in Mainland China, 2007–2016.

Rank	2007		2010		2014		2015		2016	
	Industry	Percentage	Industry	Percentage	Industry	Percentage	Industry	Percentage	Industry	Percentage
1	Electronic component manufacturing	27.68	Electronic component manufacturing	44.78	Electronic component manufacturing	24.52	Electronic component manufacturing	18.99	Computer electronics industry and optical product manufacturing	29.37
2	Computer electronics industry and optical product manufacturing	19.26	Computer electronics industry and optical product manufacturing	11.4	Computer electronics industry and optical product manufacturing	20.22	Computer electronics industry and optical product manufacturing	17.08	Electronic component manufacturing	22.12
3	Power equipment manufacturing	11.94	Nonmetallic mineral new product manufacturing	7.3	Nonmetallic mineral new product manufacturing	10.39	Nonmetallic mineral new product manufacturing	15.53	Chemial material manufacturing	11.05
4	Plastic products manufacturing	6.66	Power equipment manufacturing	6.3	Chemial material manufacturing	10.19	Paper product manufacturing	8.56	Non-metallic mineral new product manufacturing	4.65
5	Basic metal manufacturing	5.91	Machinery and equipment manufacturing	4.64	Basic metal manufacturing	5.99	Power equipment manufacturing	7.6	Chemical manufacturing	4.64
6	Machinery and equipment manufacturing	5.75	Plastic products manufacturing	3.83	Machinery and equipment manufacturing	4.83	Metal products manufacturing	5.06	Basic metal manufacturing	4.51
7	Metal products manufacturing	3.53	Metal products manufacturing	3.76	Power equipment manufacturing	4.57	Basic metal manufacturing	5.09	Machinery and equipment manufacturing	3.45
8	Non-metallic mineral new product manufacturing	2.64	Basic metal manufacturing	3.11	Metal products manufacturing	3.35	Machinery and equipment manufacturing	3.99	Power equipment manufacturing	2.72
9	Paper product manufacturing	2.04	Automobile and parts manufacturing	3.03	Automobile and parts manufacturing	3.09	Automobile and parts manufacturing	3.36	Rubber products manufacturing	2.72
10	Pharmaceutical Manufacturing	1.97	Food manufacturing	1.83	Food manufacturing	2.05	Plastic products manufacturing	3.34	Pharmaceutical Manufacturing	1.97

Appendix B

Regarding the relationship between the investment layout of Taiwanese businessmen and the spatial differences in regional carbon emissions.

In the past 40 years, there have been obvious regional differences in Taiwanese investment in the mainland. Taiwanese investment is mainly concentrated in the eastern

coastal regions, followed by the central region, gradually shifting to north and west of China. In the early stage, Taiwanese investment in the mainland was mainly concentrated in Fujian and Guangdong, and then expanded to Jiangsu, Shanghai, Zhejiang, and other eastern coastal provinces and cities, forming two core regions of Fujian–Guangdong and Jiangsu–Shanghai–Zhejiang. In recent years, the Taiwanese investment has extended from the eastern coastal regions to the northwest. The central and western regions in particular have become popular places for Taiwanese investment because of their preferential investment policies, rich natural resources, cheap land, and low labor costs.

Due to the differences in natural conditions and the imbalance of regional economic development among China's provinces and regions, the level of economic development and the environmental regulations vary greatly. The overall regional difference in carbon intensity in the mainland is characterized as high in the west and low in the east; that is, the carbon intensity is high in the western region and low in the central and eastern regions, and the carbon intensity of the eastern coastal regions is significantly lower than the national average. This is mainly because the eastern coastal regions have developed economy and high level of social development, and the corresponding environmental regulatory measures are also stricter. By contrast, the western regions have abundant energy resources, and lag behind the eastern regions in the level of economic development. Thus the local governments have adopted weaker environmental regulations than the eastern regions in order to attract more investment. There is a strong spatial correlation between Taiwanese investment in mainland China and regional environmental regulation level.

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