



# Research on Environmental Pollution under the Motivating Factors of Government Action

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**Abstract:** There are three motivating factors behind the government’s action: tax incentive, official’s promotion incentive and direct economic interests. China’s provincial panel data of 1997-2013 shows that tax incentive and official’s promotion incentive have a positive impact on the environmental conditioning, while direct economic interests, that are official corruption, will increase environmental problems. Obviously, it is not the same that different incentive factors have an impact on the environment. At the same time, foreign direct investment is surely responsible for the environmental pollution problem in China. A good institutional environment is beneficial to reduce the negative impact of foreign direct investment and official corruption on the environmental pollution. To improve the quality of environment, it needs to establish a good government internal institutional environment and effectively curb corruption; meanwhile to improve the market external institutional environment.

**Keywords:** Tax Incentive, Official Promotion, Official Corruption, Environmental Pollution, Foreign Direct Investment, Internal Institutional Environment, External Institutional Environment

## 1. Introduction

Since the reform and opening up, local governments govern regional economic development, combine with market and macroeconomic regulation, which create the miracle of China’s rapid economic growth. Local governments use market and administrative means to invest and develop market economy. On the one hand they affects business investment and production through investment promotion, capital introduction and other acts. On the other hand, they undertake industrial transformation. Thus local governments’ actions have been deeply rooted in the Chinese characteristic socialist market economy. However, China’s economy has achieved take-off with serious environmental pollution problems. Haze, water pollution, solid waste and a series of environmental problems have become commonplace, even show a growing trend.

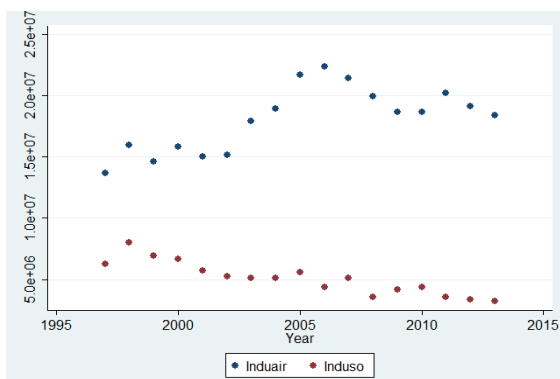


Figure 1: The air pollution and water pollution in China



Figure 2: The global air quality situation

"China Green National Economic Accounting Study Report" in 2004 shows that two-thirds cities are considered contaminated, of which two-thirds are rated as moderate or serious pollution. In the year of 2013, less than 1% of China’s 500 largest cities meet the recommended air quality standards of WHO. Meanwhile, the world’s most polluted 10 cities have seven cities in China. Yale University releases a report, "Environmental Performance Index: 2016 Report", China keeps the penultimate position in the air quality ranking, narrowly win over Bangladesh. From Figure 2, compared to other countries and regions, the air pollution is serious in China. On January 4, 2014, the health hazards of haze were incorporated natural disaster of 2013 by China National Disaster Reduction Office and the Ministry of Civil Affairs in the first time. Now, environmental problems are not only attributed to the natural, but a result of economic social activities. Fig 1 shows that air pollution, noted Induair, is still heavy, although water pollution, noted Induso, has decreased year by year. Fig 2 shows the global air quality situation.

From it, the problem of China air pollution is very serious.

Literature [1] shows that the current pattern of economic development leads to China's current environmental problems, and this pattern stems from unique government actions, exactly speaking, it is the local government's actions. Literature [2] reflects the fact that local governments play the role of social planners in the process of economic regulations, which influences investment and production, finally changes environmental quality. In fact, local governments scramble to introduce foreign capital and lower environmental standards and treat "cheap sewage cost as "cheap Labour". China has become the "Pollution Haven". A survey report by Greenpeace (2008) showed that 78.6% of multinational companies in China adopted double standards on environmental protection measures: zero emissions abroad, heavy polluters in China. Except foreign companies, government controlling the economy heavily results in trading for money and power capitalization and government allows companies to reduce pollutant emissions standards, which increase environmental pollution.

## 2. Literature review

There are three motivating factors behind the government's action: tax incentive, official's promotion incentive and direct economic interests. Literature [3] shows China's fiscal and tax reforms make local governments gained extra tax revenue, although it can't allow this surplus directly attributable to someone, while allow government officials for common economic interests. Literature [4] reports the fact that different from fiscal decentralization of Western countries, China's fiscal and tax decentralization accompanied political centralization; official's promotion inspires local government or official's to develop local economy. Undoubtedly, official's incentive is an important force boosting local government's action. However, the number of local official's promotion is less enough for officials. For some officials, they are hopeless of promotion, what they can get realistically is the direct economic benefits, which is official corruption. China always has the political tradition of promotion and fortune. Sometimes officials' direct economic benefits determine local governments' action, for example, officials gain many profits by "trading power for money" or "capitalization of power".

From the perspective of tax and promotion incentive, local governments or officials will autonomously choose GDP developmental pattern and compete for it. Literature [5] shows the more tax incentive they get from the process of economic growth, the more industrial waste emissions. However, Literature [6] stands for fiscal decentralization negatively correlates with the scale of emissions. At the same time, in order to promote, local government officials compete for GDP caused environmental pollution. However, with environmental governance as one of official's promotion indicators and the increasing environmental awareness, official's promotion may be

conductive to improving the environment. In a word, whether tax and promotion incentive aggravate environmental pollution, we need further empirical test. Literature [7] and literature [8] think there is no doubt that official corruption worsens environmental pollution problems, for the direct economic benefits. This paper will further prove the point.

There is no doubt that government action is the root of China's environmental problem, and the motivating factors are relative with environmental problem. However, there are few studies that which motivating factors function in environmental problem. Meantimes, we should face up to present institutional environment, because these motivating factors behind government action embed in present institutional environment. Literature [9], literature [10] and literature [11] show that institutional environment not only affects enterprise's transaction cost and risk, but also affects it's invest mental decision and operating. Meanwhile it has a significant impact on environmental pollution. Tax incentive causes environmental problems, but a good institution can alleviate this adverse effect. A good institutional environment will benefit the constraints of local government's excess budget, and impulse investment with economic growth standard. Literature [12] shows a good external institutional environment can effectively curb official corruption. In addition, the more clear publicity of environmental problem, the weaker environmental pollution. Literature [13] shows enterprises can be more responsible for environmental protection, with less economic intervention by government and better legal environment. In a word, a good institutional environment can effectively improve environmental quality.

In the current economic operation, government action is closely connected with institutional environment. They deeply root in the Chinese characteristic socialist market economy. The motivating factors behind government action also root in institutional environment. Therefore, this paper tries to find the different motivating factors on the impact of environmental pollution.

## 3. Theoretical Model

To get benefits from tax incentive, political promotion and direct economic interest, local government governs regional economic development. Its action influences local enterprises' production, operation and investment. In fact, local government encourages enterprises to increase investment, so officials can get more tax incentive, promotion room and more personal interests, which indirect in environmental pollution problem. Thus a good institutional environment can effectively curb environmental pollution.

This paper analyzes the nonlinear relationship of environmental pollution, government action and institutional environment by building theoretical model. Assumption that the actual environmental pollution emissions are influenced by institutional

environment and government action, the actual environmental pollution emissions  $E$  conforms to Cobb Douglas(C-D) production function form:

$$E = A \cdot P^\alpha \cdot Z(Q)^\beta \quad (1)$$

$A$  stands for other factors that may affect the actual environmental pollution emissions, such as opening trade and FDI levels.  $P$  stands for institutional environment. Institutional environment could not influence the actual environmental pollution by itself, but indirectly affect environment by affecting  $A$ .  $\alpha$  reflects a relation between the real environmental pollution emissions and institutional environment. If  $\alpha < 0$ , it shows they are negatively related with each other, that is the better institutional environment, the lower the actual environmental pollution emission. If  $\alpha > 0$ , they are positively related with each other. If  $\alpha = 0$ , they are not related with each other.  $Z$  is  $Q$ 's increasing function and stands for environmental pollution level in the process of enterprise production under the influence of government action.  $\beta$  stands for different environmental standards comparing to other region or nation. If  $0 < \beta < 1$ , it stands for local environmental standards are lower; If  $\beta = 1$ , all the region standards are same.

According to this paper's research hypothesis, the incentive factors affect enterprise's investment; its restrictive conditions are as below:

$$\pi_i(q_i) = q_i \cdot P(Q) + B(q_i) + Z(q_i/Q) \quad (2)$$

$q_i$  is investment of  $i$ . All region's investments are the whole society total investments  $Q$ ,  $Q = q_1 + q_2 + \dots + q_i + \dots + q_n$ .  $P$  is the benefit of unit investment, which is decreasing function of the whole society total investment.  $B$  is local government officials' direct economic benefits with  $q_i$ 's growth and growth.  $Z$  is official promotion incentive. Local governments rush to expand enterprise investment and compete for GDP to gain political promotion, so  $Z$  is increasing function of  $q_i/Q$ .

The paper assume that local government actions do not affect enterprise's investment, regional investment is same, so that enterprise's investment is same in each region, the most optimal total investment  $Q_0$  is as below:

$$P(Q_0) + Q_0 \cdot P'(Q_0) = 0 \quad (3)$$

Consider the kind of tax incentive, official's promotion incentive and direct economic interests, the investment ( $q_i$ ) that local government hopes will be as below:

$$\begin{aligned} \partial \pi_i(q_i) / \partial q_i &= P(q_i + \sum_{j \neq i} q_j) + \\ q_i \cdot P'(q_i + \sum_{j \neq i} q_j) &= 0 \end{aligned} \quad (4)$$

Then, the whole society total investments are as follows:

$$I \cdot P(Q_1) + Q_1 \cdot P'(Q_1) = 0 \quad (5)$$

Comparing formula (3) and (5), it shows out the result:  $Q_1 > Q_0$ . It shows tax incentive will increase the whole society total investments.

Consider tax incentive and direct economic interests, the investment ( $q_i$ ) that local government hopes will be as below:

$$\begin{aligned} \partial \pi_i(q_i) / \partial q_i &= P(q_i + \sum_{j \neq i} q_j) + \\ q_i \cdot P'(q_i + \sum_{j \neq i} q_j) + B'(q_i) &= 0 \end{aligned} \quad (6)$$

Then, the whole society total investments are as follows:

$$I \cdot P(Q_2) + Q_2 \cdot P'(Q_2) + \sum_{i=1}^I B'(q_i) = 0 \quad (7)$$

Comparing formula (5) and (7), we shows out the result:  $Q_2 > Q_1$ . It shows tax incentive and directs economic interests will increase the whole society total investments.

Consider three kinds of incentive factors, the investment ( $q_i$ ) that local government hopes will be as below:

$$\begin{aligned} \partial \pi_i(q_i) / \partial q_i &= P(q_i + \sum_{j \neq i} q_j) + q_i \cdot P'(q_i + \sum_{j \neq i} q_j) + \\ B'(q_i) + Z' \left[ \frac{q_i}{(q_i + \sum_{j \neq i} q_j)} \right] \cdot \sum_{j \neq i} q_j / (q_i + \sum_{j \neq i} q_j)^2 &= 0 \end{aligned} \quad (8)$$

Then, the whole society total investments are as follows:

$$\begin{aligned} I \cdot P(Q_3) + Q_3 \cdot P'(Q_3) + \sum_{i=1}^I B'(q_i) + \\ \sum_{i=1}^I \left[ Z'(q_i/Q_3) \cdot \sum_{j \neq i} q_j / (Q_3)^2 \right] &= 0 \end{aligned} \quad (9)$$

Comparing formula (7) and (9), we shows out the result:  $Q_3 > Q_2$ . It shows tax incentive, official's promotion incentive and direct economic interests will increase the whole society total investments [3]. The actual environmental pollution emission level is the increasing function of investment, so the increasing total investments of the whole society also increase environmental pollution. Meantime, local governments compete for GDP and lower environmental standards ( $0 < \beta < 1$ ) to attract investment. This result is based on the hypothesis: the more the investment, the more serious pollution. is the basis of the appeal of this hypothesis: the more the investment area, the more the more serious environmental pollution? However, this ignores the role of the government to improve the environment and the different enterprise characteristics.

$$E(Q) = T(Q^*_1) + H(Q^*_2) + G(Q^*_1) \quad (10)$$

$Q$  is the whole society total investment,  $Q^*_1$  is decided by tax incentive and officials promotion,  $Q^*_2$

by direct economic interests, and  $Q=Q^*_1+Q^*_2$ . E, T, H and G are functions of the investment.

$$\frac{\partial E}{\partial Q^*_1} = \frac{\partial T}{\partial Q^*_1} + \frac{\partial G}{\partial Q^*_1} \quad (11)$$

$$\frac{\partial E}{\partial Q^*_2} = \frac{\partial H}{\partial Q^*_2} \quad (12)$$

The formula (11) shows that government may have more investment in reducing pollution with more revenue, that is  $T'(Q^*_1) > 0$  and  $G'(Q^*_1) < 0$ . The symbol of the  $E'(Q^*_1)$  cannot be determined, that is  $E'(Q^*_1) > 0$  or  $E'(Q^*_1) < 0$ .

The enterprises, bribing to government, are often highly polluting enterprises. Therefore, the more serious direct economic interests that is official corruption, the more serious pollution. The result is that  $E'(Q^*_2) = H'(Q^*_2) > 0$ .

In summary, it is uncertain that tax incentive and officials promotion will aggravate environmental pollution and determinate that direct economic interests will aggravate environmental pollution. It need to distinguish which incentive factor impacts on the environmental pollution and verify how institutional environment impacts on environmental pollution. The empirical analysis and test are as below.

#### 4. Empirical analysis

##### 4.1. Test model

According to the building theoretical model of this paper, this paper use provincial panel data from 1997 to 2013, and empirically test the impact that institutional environment and motivating factors have on environmental pollution.

$$Y_{it} = \alpha_i + \beta_i + \zeta_0 Govbeh_{it} + \zeta_1 Control_{it} + \zeta_3 Index_{it} \cdot Control_{it} + \varepsilon_{it} \quad (13)$$

In this model, i stands for region, t stands for year. Y stands for explained variable that is local environmental pollution level. Govbeh stands for the motivating factors. Control stands for a set of control variable related to environmental pollution level. Index stands for institutional environment.  $\alpha$  stands for individual effect of model exist,  $\beta$  stands for time effect of model exist, and  $\varepsilon$  stands for disturbance.

##### 4.2. Indicator selection and descriptive statistic

Explained variable: environmental pollution level. China's environmental pollution mainly comes from industrial production, some literature mostly use industrial waste emission index to measure the overall environmental pollution level. Based on the existing literature and considered the availability of data, this paper select unit GDP's chemical oxygen demand emissions of industrial waste water and sulfur dioxide emissions of industrial waste gas as indicators of environmental pollution level.

Independent variable: government action's incentive factors, institutional environment. The incentive of local government action stem from tax incentive, promotion incentive and direct economic benefit. This

paper use "Fisdec", a proxy for tax incentive and promotion incentive, is local fiscal output capacity coefficient that is the ratio between local fiscal capacity and output.

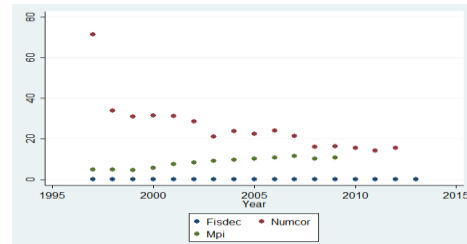


Figure 3: The incentive factors of Shanghai

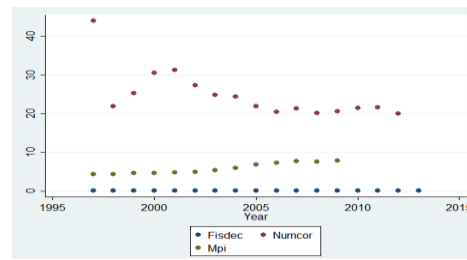


Figure 4: The incentive factors of Anhui

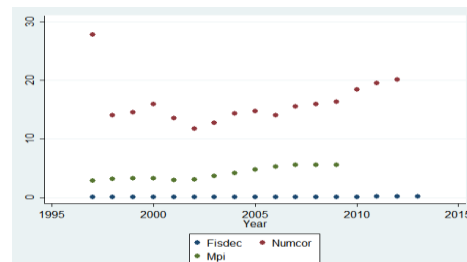


Figure 5: The incentive factors of Qinghai

Local fiscal capacity is presented by general budget revenue. Official corruption mainly reflects direct economic interest, noted Numcor, measured by official corruption crimes in per one million populations in the every province. Institutional environment is the basis and premise of enterprise technology innovation and marketization degree is an effective measure index of institutional environment. So this paper uses "regional marketization index" as an effective measure index of institutional environment, noted Mpi. The greater Mpi, the higher marketization level and the better institutional environment. Because of unbalanced regional development in China. This article will regards Shanghai as the representative of eastern provinces (Fig 3), Anhui as the representative of central provinces (Fig 4) and Qinghai as the representative of western provinces (Fig 5). From figure 3-5, their tax incentive and official's promotion incentive are broadly consistent. However, official corruption is different among different provinces. Generally speaking, the more poor development of economic regions, the more serious official corruption.



**Table 1:** The descriptive statistics of variables

Variables	Connotation	Min	Mean	Std	Dev
Induso	Chemical oxygen demand /GDP	-3.15	1.53	-8.34	1.24
Induair	Sulfur dioxide emissions /GDP	4.38	1.11	0.43	6.90
Fisdec	Local fiscal output capacity coefficient	-2.57	0.31	-3.39	-1.67
Numcor	Number of official corruption cases/Million population	3.35	0.36	2.30	4.88
Mpi	Regional marketization index	4.76	0.90	0	5.73
Fdi	FDI/GDP	-4.09	1.14	-11.18	-1.80
Open	Gross import and export value /GDP	-1.78	1.02	-3.44	0.54
Industry	Industrial added value/GDP	-1.02	0.37	-2.66	-0.63
Evegdp	Actual per capita GDP	1.84	0.48	0.76	3.16

Note: Logarithmic transformation of all variables, except for Mpi.

**Table 2:** Environmental pollution under tax incentive and promotion incentive

Variables	Explained variables			
	Induso		Induair	
	(1)	(2)	(3)	(4)
Fisdec	-1.58*** (-5.6)	-2.09*** (-6.3)	-1.71*** (-18.0)	-1.51*** (-13.5)
Fdi	0.27*** (3.6)	0.22** (2.2)	0.19*** (7.4)	0.17*** (5.06)
Open	-0.40*** (-2.6)	-0.66*** (-3.2)	-0.04(-0.8)	-0.08(-1.2)
Industry	-1.14** (-2.4)	-1.12* (-1.9)	0.82** (5.1)	0.99*** (5.0)
Evegdp	-2.43*** (-4.7)	-1.22* (-1.7)	-1.87*** (-10.8)	-2.13*** (-8.6)
Fdi•Mpi		-0.001(-0.9)		-0.0003(-1.1)
Open•Mpi		0.003*** (3.4)		0.0003(0.9)
Industry•Mpi		-0.003* (-1.7)		0.0001 (0.1)
Evegdp•Mpi		-0.002*** (-2.6)		-0.001** (-2.1)
Constant	-3.54** (-2.0)	-7.25*** (-3.5)	4.95*** (8.2)	6.10*** (8.8)
Individual effect	YES	YES	YES	YES
Time effect	YES	YES	YES	YES
F	75.8	36.4	340.1	82.24
R <sup>2</sup>	0.439	0.474	0.778	0.6716
N	520	402	520	402
Hausman	0	0	0	0

Note: \*p<0.10, \*\*P<0.05, \*\*\* P<0.01.

Control variable: To get robust estimation results, this paper introduces the following variables as control variables: (1) foreign direct investment, noted Fdi, measured by foreign direct investment ratio of GDP. Environmental standards in developed countries are higher than developing countries, which make high pollution industries transfer to developing countries. Now developing countries have become "pollution haven". (2) The degree of trade openness, noted Open, measures by the ratio of import and export and GDP. With China's opening degree is more and more high, environmental standards and regulations are more and more similar with the world. So the higher degree of trade openness, the lower pollution level. (3) Industrial structure, noted Industry, is measured by its added value accounting for a share of GDP. Generally, the ratio is high, environmental pollution is heavy. However, China take a new road to industrialization, the coefficient is not sure. (4) Per capita economic development level, noted Evegdp, is

measured by GDP and removes the influence of the price. The higher Evegdp, the intensive environmental protection consciousness. Expected the coefficient is negative, namely in China's present economic condition, the higher level of economic development, the lower level of environmental pollution. Table 1 is the descriptive statistics of variables.

### 4.3. Data sources

This paper uses China's 31 Provinces Panel Data from 1997 to 2013. Pollutant emissions stem from "China Environmental Yearbook". Corruption crime numbers stem from the contents of annual report submitted to the Provincial People's Congress by provinces, municipalities and autonomous dean. The process of regional marketization index is derived from the book, "The Chinese Market Index", which is compiled by Fang Gang et al. The rest are derived from "China Statistical Yearbook".

**Table 3:** Environmental pollution under direct economic benefits

Variables	Explained variables
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	Induso		Induair	
	1	2	3	4
Numcor	1.24 <sup>***</sup> (7.1)	0.82 <sup>***</sup> (4.5)	0.69 <sup>***</sup> (10.0)	0.56 <sup>***</sup> (8.2)
Fdi	0.18 <sup>**</sup> (2.4)	0.24 <sup>**</sup> (2.3)	0.13 <sup>***</sup> (4.4)	0.19 <sup>**</sup> (5.0)
Open	-0.42 <sup>***</sup> (-2.8)	-0.84 <sup>***</sup> (-4.1)	-0.15 <sup>**</sup> (-2.5)	-0.22 <sup>***</sup> (-2.9)
Industry	-0.46(-1.0)	-0.86 (-1.43)	1.50 <sup>***</sup> (7.9)	1.18 <sup>***</sup> (5.3)
Evegdp	-4.13 <sup>***</sup> (-10.0)	-3.17 <sup>***</sup> (-4.5)	-3.72 <sup>***</sup> (-22.6)	-3.53 <sup>***</sup> (-4.5)
Fdi•Mpi		-0.001 <sup>*</sup> (-1.9)		-0.001 <sup>***</sup> (-3.1)
Open•Mpi		0.002 <sup>***</sup> (3.2)		0.0002 (0.6)
Industry•Mpi		-0.001 (-0.5)		0.001 <sup>**</sup> (2.4)
Evegdp•Mpi		-0.002 <sup>**</sup> (-2.5)		-0.0005 <sup>*</sup> (-1.9)
Constant	-0.183 (-0.14)	-1.086 (-0.64)	10.740 <sup>***</sup> (20.23)	10.632 <sup>***</sup> (17.04)
Individual effect	YES	YES	YES	YES
Time effect	YES	YES	YES	YES
F	79.40	32.71	189.79	56.42
R <sup>2</sup>	0.4638	0.4485	0.6740	0.5838
N	495	402	495	402

#### 4.4. Empirical result analysis

This paper uses estimate fixed-effects based on panel data. Table 2 shows how tax incentive and promotion incentive effect environmental pollution. From Table 2, it will conclude the result in all models that Fisdec will improve the quality of the environment and the coefficients are significant at 0.01 significant levels. It suggests tax incentive and promotion incentive negatively relate with environmental pollution, namely the former benefits to reduce the latter. Meanwhile, Fdi is positively correlated to the level of environmental pollution and the coefficients are significant. It confirms a fact that China has become "pollution haven", while good institutional environment can reduce this adverse effect. From model (1) and model (4), the coefficients of Fdi are reducing. The degree of trade openness is negatively correlated with environmental pollution: the higher degree of trade openness, the lower environmental pollution. Industrial structure impacted on environmental pollution appears uncertain results. Model (1) and model (2) collectively show the improvement of industrial structure will reduce environmental pollution. Model (3) and model (4) collectively suggest industrial structure has negative effect on environmental pollution and the reason why it has the outcomes is that China is taking a new road to industrialization and new industry and traditional industry exist. The higher per capita level of economic development, the lower degree of

environmental pollution, which conforms to the previous assumptions.

Table 3 shows direct economic benefits, namely official corruption, have impact on environmental pollution. From Table 3, it will conclude the result in all models that Numcor will deteriorate the quality of the environment; the coefficients are significant at 0.01 significant level. It suggests official corruption is positively related with environmental pollution that is the more serious official corruption, the more heavy environmental pollution. Model 1 to 2 and model 3 to 4, the coefficient value is smaller. Good institutional environment can reduce negative effects on environmental pollution. At the same time, the relationships between four variate: direct investment and trade openness, industrial structure and economic development and the level of environmental pollution consistent with the results in table 2, which make conclusion more robust.

#### 5. Conclusion

Empirical results show that tax incentive and promotion incentive reduce the degree of environmental pollution, and official corruption aggravates the environmental pollution. Obviously, it is not the same that different incentive factors have an impact on the environment and foreign direct investment is surely responsible for the environmental pollution problem in China. Meantime a good institutional environment can effectively reduce negative effect. All in all, government action is the root of China's environmental problem. Improving environmental quality and reducing pollution level, on

the one hand it would need to curb corruption of government officials and establish a good internal institutional environment, on the other hand to shape a good external market environment.

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