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The Relationship between Marketization Level and Environmental Quality in China

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Abstract

Affected by the global financial crisis, China has proposed a 4-trillion-yuan stimulus package. To dispel the impact and balance the economic growth and ecological improvement, marketization may be an effective means. The article tries to explore the relationship between the two sides. By analyzing the impact of the mechanism between marketization and environmental quality, with the help of econometric model, the quantitative analysis has been made on the above basis. The result shows that with the rising level of Chinese national marketization, the pollution loads of Sulphur Dioxide and Chemical Oxygen Demand of gross industrial output value per 10000 yuan are both on the decline. By modeling SO_2 and COD of unit (per 10000 yuan) gross industrial output value and marketization level of 31 provinces in China, the results indicate that the higher the marketization level of a province, the lower emissions of either SO_2 or COD. Therefore, the marketization level will better the environmental quality. Relevant solutions are also proposed.

Keywords: Marketization level; Environmental quality; Pollution load

Given the ongoing world financial crisis, China has also been more or less influenced. How to balance the relationship between economic development and environmental (or ecological) improvement becomes a big challenge for policy makers. To fight the financial turmoil, China has proposed a 4-trillion-yuan stimulus package, whose purpose can be summarized as boosting domestic demands, ensuring economic growth, making structural adjustment and securing people's livelihood. To achieve the win-win goal between economy and environment, marketization may be an effective means.

1. Mechanism between marketization and environmental quality

Market mechanism can affect the environmental quality indirectly. According to statistics, the past decade marks the fastest marketization transition period for China economic institutional reform, during which the annual economic growth rate exceeded 8 percent, whereas, the main pollutant emissions reduced by 15 percent (Xie, 2002). Marketization, on the one hand, is in conflict with environment, but on the other hand, the two sides may be compatible with (Zhang, 2003, pp.142-143).The measure of marketization can be expressed either by the classical indicator like GDP, gross industrial output value, or by chief pollutant indicators which represent environmental quality such as Sulphur Dioxide (SO_2) and Chemical Oxygen Demand (COD).

1.1 Short-run impact analysis

In the short run, with the periodical or structural characteristics of economic growth, the environmental quality which is the byproduct of economic development might deteriorate, for instance, the current industrial progress accelerates the phase of heavy industrialization in China, with the rapid development of construction on urban infrastructure, the steel and chemical industries have been boosted. Because of long chain and long production period features, the heavy industry has a strong demand on energy and resources consumption, it can be ranked among high capital input and high energy consumption sectors, the heavy industrial characteristic inevitably will threaten to undermine the quality of economic development. Since 2000, Heavy industry has exceeded 60%, the rebound of industrial pollution in recent years is triggered by heavy industry development, which confirms the finding that China is still on the left side of the Environmental Kuznets Curve picture (CAS, 2001), and therefore, the task for China's energy-saving and emission-reducing still has a long way to cover.

1.2 Long-run impact analysis

In the long run, the rising level of Chinese marketization will help enhance eco-environmental quality. Main factors are

listed below.

1.2.1 The fundamental change of economic growth model

The change of economic development model is based on the transition of economic system. It is necessary to give full play to market mechanism in allocating resources, press ahead the resources allocation to transform from the way of non-marketization under planned economy system whose efficiency is low or void to market oriented economy whose efficiency is relatively high, thus, the approach of economic development can be shifted from extensive type to intensive type gradually (Li, Guozhu and Ma, Shucai, 2007, pp.61-68).

1.2.2 Marketization and environmental economic policy

In market economy, government tries to fulfill his goal of environmental protection by certain measures including stipulating decree, regulation, standards, bans, and permits (certificates), which have been proved effective by developed countries. Whether to employ current market or to create new market should be based on the real circumstances. The results of environmental policy depend on the level of marketization perfection. Given non-perfect market and false environmental information, the practical results might be of low efficiency or void. Presently during the course of environmental management, Chinese government takes market methods more often than not, and the level of marketization is becoming higher and higher, concrete methods such as rights of pollutant trading, tradable permits and ban on free plastic bag are widely used, particularly the ban on free plastic bag (or plastic limit order) on Jun 1st, 2008, is a good case in point. Together with the performance of the 11th five-year planning started from 2006, among which two specific goals to promote the energy-saving and emission-cutting—energy consumption of unit GDP being reduced by 20 percent and the decrease of chief pollutant emissions (SO_2 and COD) by 10% are included, market perfection and effects of environmental economic policy, the environmental quality can be bettered progressively.

1.2.3 Annual increase in environmental protection investment

According to China statistical yearbook in 2007, from the years 2001-2005, the yearly investment in China's pollution prevention and treatment accounted for 1.01%, 1.14%, 1.20%, 1.19% and 1.30 % of GDP respectively. On the whole, China is in the phase of effective pollution control, but the investment on environmental protection is increased year-on-year, which will guarantee the continual improvement of environmental quality.

1.2.4 The deepening of environmental protection concept of local governments and enterprises

With the deepening of environmental protection concepts, more and more local governments and far-sighted enterprises, come to realize that the environment quality is also a kind of production force, in effect, a more lasting competitive advantage. For example, in many Chinese mainland cities, which currently face the tough challenge of a new round of industrial restructure and technical update as well as the financial turmoil, local governments begin to raise threshold when attract investment from home and abroad. They not only pay attention to the economic benefits, but also make more efforts on environmental and social benefits, meanwhile, require new projects to pass both the environmental impact assessment and the energy assessment review. Only by so doing, can environment and development quality of regional economy be ensured. Scores of enterprises with a strong sense of social responsibility respond actively to enhance the level of environmental protection by means of technological innovation, for instance, some power plants purchase desulphurization equipment, and some manufactures of home appliances focus on improve the rank of China energy label.

1.2.5 Measures on energy-saving and emissions-reducing

With the construction of resources-saving and environmental-friendly society in China, particularly the current measures on saving energy and reducing emission, the environmental quality will be progressively enhanced, which can be confirmed by the figures announced by China Finance Ministry in 2008: 27 billion special funds were allocated to advance the process of energy-saving and emission-reducing. According to Xinhua news agency on Sep 10th, 2008, which reported that during the first half of 2008, the emissions of the two main pollutants: COD and SO_2, are both on the decline, of which the SO_2 emission is roughly 3.96% compared with the previous year, and that of COD is 2.48%, indicating the policies and measures of emission constraints do work to some extent. Of course, results achieved are also the joint contribution of engineering, structural and managerial emission reduction as well as the practice of circular economy.

1.2.6 The international consensus and cooperation on Climate change

The impact of environmental problems, especially climate change, is worldwide. To address the rising of global temperature, cutting carbon emissions is an available ways. The deepening of emission reduction activities of developed countries are the central topic for the new round of UN negotiation on climate change in Bangkok, and also the key to Copenhagen negotiation to be held this year, which will make arrangements for after 2012 corporation on global climate change. According to Kyoto protocol, how to effectively promote the technical and capital aid from developed countries, support developing countries to mitigate and adapt to the impact caused by climate change is another topic for the new

round negotiation. With regard to this issue, China proposed that developed countries input 0.5 percent of their annual GDP to help developing countries, while Germany put forward auctioning of emission rights and use the yields by such deal to realize cooperation. A statement which supports the use of market trading on CO_2 emissions was also passed in Bangkok (Qi, 2008, pp.68-70). The trading mechanism on carbon dioxide emissions aims to reduce greenhouse gases. According to the Kyoto Protocol, market participants can trade emission allowances to make reductions. With emission trading, emitters also face incentives to find innovative ways to reduce their emissions and thus sell excess allowances or reduce their need to buy allowances (Neuhoff, 2007,pp.175-176). As the atmosphere is a shared resource, all countries have responsibility to take action but industrialized countries should take the lead, given their dominant role in creating the problem. For the first commitment period of the Kyoto Protocol (from 2008 to 2012), countries with targets are required to reduce their greenhouse gas emissions to an average of 5 percent below their emissions in 1990. Most of the world developing countries are encouraged to take action to reduce emission under the Kyoto Mechanisms, in particular the Clean Development Mechanism (CDM), which allows carbon credits generated from emissions reduction projects to be used(habbitts,2007, pp.295-297).

2. Analytical methods and results

2.1 Model and results on national marketization level and ecological quality

2.1.1 Econometric model

Basic data include: China national index of marketization and that of the 31 provinces across China (Fan et. al, 2007, pp.6-8), SO_2 and COD of unit gross industrial output value from 2001-2005. The model function listed below is derived by comparing several estimated curves done by SPSS software, which indicates the link between pollutant load in unit gross industrial output value and marketization level.

$y=ae^{bx}$

Where

y annual SO_2 or COD emission in unit gross industrial output value

x marketization index of the corresponding year

a, b model coefficients.

2.1.2 Results analysis

The model result suggests that, with the rising of the maketization, pollutant loads of SO_2 and COD of unit gross industrial output value are both on the decline, and the values of R^2 exceed 0.8, which indicate that the model conforms well to the real situation. To be specific, the emission of SO_2 in the first half of 2008 reduced by roughly 3.96% compared to the same period of last year, while COD reduced by 2.48%.

Based on SO_2 and COD emissions in unit gross industrial output value at 2000 prices, Our preliminary calculation of unit SO_2 discharge has shifted from 0.036 ton in 2001 to 0.023 ton in 2005, while the COD has changed from 0.026 ton to 0.013 ton in the same period, during which Chinese marketization level has risen from 4.64 to 6.52.Obviously, to some extent, marketization approach plays an important role in promoting China economic growth, pressing the work of energy-saving and emission-reducing, and improving the quality of economic operation.

2.2 Model and results on marketization level and ecological quality in 31 provinces

2.2.1 Panel data Model

Basic data include: China marketization index of 31 provinces from 2001-2005(Fan et. al, 2007, pp.6-8), SO_2 and COD of unit gross industrial output value in corresponding years. Of which, the gross industrial output value and SO_2 or COD discharge are taken from China environmental yearbook. Using 2000 as a base, the original figures of 31 provincials' gross industrial output value were converted into the ones at 2000 prices to eliminate price impact.

The paper uses panel data model to further the analysis. Generally speaking, when choosing a model, we usually do model test by F statistic variable which is formulated from the residuals of constraint and unconstrained regression. By virtue of Eviews software and the F test, the paper then chooses the time-fixed effects model with changing intercept as suitable model to make relevant analysis (Zhang, 2007). Of which, the time-fixed effect model with changing intercept is listed below,

$$y_{it} = \beta_1 x_{it} + \alpha_1 + \alpha_2 D_2 + \alpha_3 D_3 + \cdots + \alpha_T D_T + \varepsilon_{it}, \; i=1, 2,\ldots, N$$

Where

$$D_i = \begin{cases} 1, \textit{for section } t,\ t = 2,\ldots, T \\ 0, \text{ other } \textit{cases} \end{cases}$$

y_{it} SO_2 or COD emissions of gross industrial output value per10000 yuan (or unit gross industrial output value) of individual *i* in the time of *t*

x_{it} Marketization level of individual *i* in the time of *t*

In either y_{it} **or** x_{it}, the subscripts assignment of *i* and *t* are,

i = 1,…,31

t =2001,…,2005

ε_{it} Random error

2.2.2 Results analysis of panel data model

The model results show that the rising level of marketization contributes to the continuous improvement of environmental quality in 31 provinces. To be specific, with every unit rising of marketization index, SO_2 emission of gross industrial output value per 10000 yuan will reduce by 7.5575 units. By further analysis, the conclusion is that the higher the marketization level, the lower the SO_2 emission in unit gross industrial output value. Take the marketization level in 2005 as an example, the top ten provinces are Shanghai(10.41), Guangdong(10.06), Zhejiang(9.90), Jiangsu(9.07), Beijing(8.62), Fujian(8.62), Tianjin(8.34), Shandong(8.21), Liaoning(7.84) and Hainan(5.54) in sequence, of which, Beijing and Fujian are of the same market level. Here, the figure between brackets represents the overall marketization level of each province, and moreover, the larger the figure, the higher the marketization level. When it comes to SO_2 emission in unit gross industrial output value—ton per 10000 yuan, the sequences of last ten provinces are Shanghai(0.004), Beijing(0.007), Tianjin(0.007), Hainan(0.007), Jiangsu(0.012), Fujian(0.012), Zhejiang(0.013), Shandong(0.017), Guangdong(0.017) and Liaoning(0.019), among which, Beijing, Tianjin and Hainan are of the same discharge level, Jiangsu and Fujian are of the same, Shandong and Guangdong are the same. Since the regression equation reflects the average characteristics rather than individual ones, the negative slope of the equation shows that there is a relation between marketization level and environmental quality, furthermore, the absolute value of the slope, with the figure of nearly 7.6, is relatively big, which demonstrates that the marketization level can quickly influence environmental quality.

So it is with the COD emission. To be specific, with every unit increase of marketization index, the COD emission per gross industrial output value will decrease by 1.0751 units. Further analysis shows that the higher the marketization level, the lower the discharge of COD in unit gross industrial output value—ton per 10000 yuan. Still take the marketization level in 2005 as an example, the top ten provinces are Shanghai, Guangdong, Zhejiang, Jiangsu, Beijing, Fujian, Tianjin, Shandong, Liaoning and Hainan in sequence. Of which, Beijing and Fujian are of the same level. With respect to the COD emission in unit gross industrial output value, the last ten provinces are Shanghai(0.003), Beijing(0.004), Tianjin(0.004), Shandong(0.006), Jiangsu(0.009), Zhejiang(0.009), Fujian(0.010), Liaoning(0.010), Guangdong(0.014) and Hainan(0.028) in sequence. Among which, Beijing and Tianjin are of the same emission level, Jiangsu and Zhejiang are the same, Liaoning and Fujian are also the same. Similar to the reason of SO_2, the minus slope of the equation shows that there is a link between marketization level and environmental quality. And moreover, the absolute value of the slope, being 1.08, demonstrates that the marketization level can influence environmental quality to a certain degree.

If compared with the pollution load on unit industrial output value of SO_2 and COD, it is clear that the level of SO_2 emission reduction is much larger than that of COD, and the former is roughly 7 times of the latter. The achievements cannot be made without strictly curbing projects with characteristics of high pollution, high energy consumption and low efficiency to be passed, strengthening desulphurization on newly industrial or technological projects, making stern environmental impact assessment and energy saving review. In the meantime, the reason behind the achievements also tells that it is necessary to adopt new advanced sewage treatment technology to improve the treatment rate, and strengthen the emission reduction on COD to a new level. Only by so doing can the eco-environmental quality be gradually improved and the ecological civilization be established.

In addition, environmental quality varies from year to year. Other than 2003, in terms of SO_2 discharge model, the individual time to total average condition appears to decrease gradually. And so it is with COD. The achievable results reflect that, to some degree, there is a beneficent cycle between marketization level and the improvement of environmental quality.

2.3 Conclusions and discussion

According to the above analysis, the following can be derived or be further proved.

(1) Since 2001, the pollution load of SO_2 and COD in gross industrial output value per 10000 yuan has shown the tendency of downturn. Especially in 2008, the main pollutant emission in China appeared dual decline, partly achieved

the binding targets set in 2006.

(2)Compared with industrialization countries, China's marketization level has unique characteristics: given a human population of 1.3 billion, the natural resources per person in China becomes very small, just because of the conflicts between huge population and resources scarcity, the environmental assets are virtually over consumed, the carrying capacities are outstripped. Meanwhile, China marketization progress is complicated and compressed: it is not directly shifted from natural economy, but changed rapidly from planned economy to market economy. As a result, it has features such as traditional institutional barrier, big transitional difficulty and high reform costs. To ensure the successful transition, great efforts need to be made accordingly. For instance, continuing to give full play to market mechanism, and increase the financial input on environmental protection.

(3)Marketization is helpful to China economic growth, the win-win goal between economic development and environmental protection is an exciting and worthy one both in theory and in practice. Currently, China has also been more or less influenced by the ongoing financial crisis. For instance, the economic growth rate for 2009 has to be customised and tailored to 8 percent or so. If compared with 2008, which was 9 percent, the figure is a little bit decrease. Other policies including boosting domestic demands and making structural adjustment are also been made to reverse the economic downturn. In this scenario, to fulfill the set targets on pollution control and emission reduction is not that optimistic. To minimize or dispel the mentioned unfavorable impact and achieve the win-win goal of economic development and environmental protection, stronger and more effective solutions must be taken in time.

3. Solutions

The win-win goal between economic and environmental cannot win overnight, certain measures encompassing continually moving forward the energy-saving & emission-reducing project as well as marketization reform, developing circular and low-carbon economy, adopting the integrated decision-making policy and some other concrete actions must be taken.

3.1 Advance the marketization process

Marketization is an effective means, and it can allocate resources more efficient in most cases. The economic achievements of China's reform and opening-up practice over the last three decades have well illustrated the role of market mechanism. The above discussion has indicated the close relationship between marketization level and ecological quality. Whether from the viewpoint of tackling the current financial crisis or from the perspective of promoting China's economic development and ecological quality, marketization is a rational option for furthering relevant reform in the long run.

3.2 Develop circular economy

China promotion law of circular economy has taken effective since Jan 1st, 2009. In practice, Chinese circular economy means to lead enterprises to take the newly industrialization way whose features include high value added of technology, high economic benefits, low resources consumption and giving full play to the advantages of human resources, and finally establish the desired economic model, namely, the circular economy by Chinese way. To our understanding, the Chinese circular economy model can be explained in three aspects: firstly, it means to consider every enterprise as a unit, encourage them to implement clear production, and build up small-sized recycling system. Secondly, it regards every industry or sector as a unit, requires each unit to extend industrial chain and set up medium-sized recycling system. And thirdly, the whole city or country should also be viewed as a unit, thus far, the circular economy is carried out across the whole society, which is the large-sized recycling system. And environmental management methods like the from-cradle-to-grave should also to be encouraged to promote the circular economy practice.

3.3 Implement the integrated decision-making mechanism of environment and development

The integrated decision-making mechanism of environment and development means that in the process of decision-making, the aspects of environmental, economic and social development should all be taken into consideration. In other words, when to make decision, the best equilibrium point among environmental, economic and social affairs cannot be found till all the three aspects are well balanced. Only by so doing, can the goals of economic development, social progress and environment protection be harmoniously fulfilled. Here, the word 'environment' in the mechanism actually refers to environmental protection, and development means the economic and social development. Only when environment and development are considered together, can the concept of sustainable development be understood correctly. At present, China is in the transitional period from traditional way of high economic growth and high pollution level to the sustainable one of high economic growth with low pollution level. According to the report of China national statistics bureau on Oct 27th, 2008, by the year 2007, with income per capita reaching $2360, China has entered the rank of lower-middle-income countries according to the income standard released by the World Bank and the gap between China and the recognized $4000-5000 per capita GDP which is the turning point of Environmental Kuznets Curve is continuing to narrow. The improvement of environmental quality may not be happened automatically with the rising of income level, for there are several other factors affecting the environmental quality, besides income,

other elements such as national or regional environmental policy, industrialization progress and social and natural factors are also crucial. In this case, the integrated decision-making mechanism should be strictly carried out, meanwhile, displaying the late comer's advantage fully and avoiding the way of polluting first and harnessing later are also of vital importance.

3.4 Increase investment in environmental protection

During the marketization process, in specific stage, the conflict of capital use between economic development and environmental protection is inevitable. According to the practice of developed countries, different environmental quality has different demand on environmental protection investment, to be specific, when the proportion of environmental investment of GDP accounts for 1%-1.5%, environmental pollution can be effectively controlled, and in the rage of 2%-3%, it can be bettered gradually, only when the number exceeds 3%, can it be improved fundamentally. As noted earlier, as a developing country, Chinese economy and environmental protection has a compressed character which is quite deferent from the developed country. Despite the global financial crisis, China should pay more attention to the quality of economic growth, whereas the continuous improvement of environmental quality is the important part. To ensure the ecological quality, certain investment must be injected to environmental protection. Meanwhile, the funds efficiency should also be raised. To dispel the impact caused by the global financial crises, China central government has put forward ten measures to expand domestic demands and guarantee economic growth. The 4-trillion-yuan stimulus package includes a 210-billion-yuan investment in energy conservation and ecological engineering, which will ensure the continuous improvement of environmental quality.

3.5 enhance the work of energy-saving and promote emission-reducing and develop renewable energy

Energy-saving and emission-reducing is the task for all humankind, and the technological innovation is the fundamental way out. The essence of environment problem nowadays is actually a development problem. The issue of energy-saving and emission-reducing means both challenge and opportunity. For China is in the phase of quick industrialization and urbanization, it is crucial to enhance the work of energy-saving and emission-reducing, which is not only the effective move to promote product update but also the good practice for pushing the ecological civilization as well as cultivating the public awareness of energy-saving and the construction of eco friendly society. The civil society calls for every enterprise and every society member to develop the habits of saving energy and protecting the environment. A concrete example in point is that, on March 28th, 2009, many Chinese big cities and its people taking responsibility willingly by turning off lights on 'earth hour' to save energy as well as to fight climate change. In addition, vigorously developing the renewable energy resources can also help better ecological quality and protect the ecosystem. In effect, whether to conserve energy, to cut emission or to develop renewable energy, they all contribute to sustainable development.

3.6 develop low-carbon economy and construct ecological civilization

The high-carbon economy will definitely hurt the future development, while the low-carbon one will be sustainable. To fight the global climate change, every country should control or cut emissions of CO_2 and other greenhouse gases, for atmosphere is a shared resource. International cooperation should also be strongly strengthened. As a responsible developing country, China has already taken concrete actions to climate change: the ongoing project for energy-saving and emission reduction which began in 2006 in the 11th five-year-plan is a good case in point. Let alone the successful 2008 Olympic Games held in China with slogans of green Olympics, scientific Olympics and humanistic Olympics. Currently, Chinese government calls for his people to build ecological civilization vigorously, which, in essence, is the same to the construction of resource-saving and environmental friendly society. The Chinese trading framework of carbon balance is one more meaningful work in resolving the conflicts between economic development and environment protection. By so doing, China can build up low-carbon economy and fulfill the goal of ecological civilization progressively.

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