The water resource development in China

Introduction

Chinese history is full of floods and droughts, so that prominent Chinese statesmen such as Da Yu and Li Bing have since ancient times given bureaucratic attention to water control and management. It is well known that China is counted as one of the ancient hydraulic societies. By giving high priority to water resource development, the Communist government has, since 1949, strengthened the traditional state control of water use, and has had many great achievements in its construction. For instance, the Three Gorges project will be the largest hydroelectric dam in the world after it is finished. It will be diverting water to the water-scare North China Plain and supplying one tenth of the electricity of the whole country. It will be used specially for supporting development in the northwestern China (SEPA, 1995).

Although the current regime may have devoted more money and bureaucratic attention to the problem of water resources than previous governments, water shortages and water pollution are still chronic problems in China, where people are relatively poor in water resources, especially in the Northern area. According to the World Bank's research, per capita water resources in China, on average, are less than one third of the world average, while in the North it is only about 10 percent (Wang and Lall, 1997). Indeed, many scholars and others attribute the deepening environmental and ecological crises all over China to the decentralization of post-Mao economic reforms. It is time to solve the problem in a new way, to not only focus on the major constructions but also put effort into the economic efficiency of water use. In China, water-use rights, are solely owned by the State. But the central planting of water use does not allocate water

resources efficiently; on the contrary, it is the worst problem. In this paper, I will analyze the economic failures of water resource intervention in China.

Lack of water property right

The Coase Theorem emphasizes that if property rights are well defined, then it may be possible for the parties involved to reach an efficient solution by bargaining among themselves (Coase, 1960). However, because of water's physical and economic attributes: mobility, solvent properties, sequential use, and economies of scale, and complementarities of outputs. It is difficult to specify clearly the property rights of water use. Especially in socialist China, water is absolutely a public good. But the public intervention does not allocate water resources efficiently; on the contrary, it is the worst problem.

One of the greatest merits of the Communist Chinese government, which came to power in 1949, has been to draw a practical conclusion from Chinese history and from practical experience in the liberated areas. The conclusion of the development of water resources can be said to be articulated by three policy slogans, which are often quoted by officials and publications (Friedmann, 1959). These are:

- Water is the lifeline of agriculture
- Agriculture is the foundation and industry the leading factor of national economy
- Construction is the base; management is the key of water projects.

The main problem was that even those "beautiful" slogans had pointed out the importance of water, however, they had not clearly mentioned the property right of water

resources. Thus, those slogans cannot solve the economic problem such as: How to allocate water between agriculture and industrial use? Who has the priority to use water? How to manage the water resources, and what are the key rules? Those problems led the new government into a dilemma of balancing the traditional versus modernization. International experts have speculated that increasing industrialization in the region would cause water to be diverted away from agriculture. This has already happened to farmers around Beijing municipality, who reacted by switching from grain to crops that use less water. Extension of this trend across the whole region would lead to a big reduction in grain production that China could only make good by increasing its purchases on the international market. Privatizing all the water resources may not be the optimal solution. However, the constitution should definitely provide the clearly water-use rights, the rules stating when, where, how, who can use the water resources.

Informal legal decision

The Chinese water resources development has not been achieved on a legal basis similar to the Western meaning of parliamentary tradition. In general, a formal legal structure has never been very important in rather homogenous agrarian communities such as Chinese society before 1949 and even in many Third World countries today. Therefore, traditionally in China, disputes and conflicts were commonly handled on a non-legal basis by local leaders. Conflicts were considered to be a disturbance to the overall social harmony. By use of their moral leadership, the local leaders were assigned by the "Confucian" bureaucracy to restore the social harmony. The new government adhered to this old tradition. The Communist party and its leaders at all levels may be

said to have exercised the Confucian notion of moral leadership (Myrdal, 1965). However, there is an important difficulty, as even the professional economists cannot determine the cost and benefit of resource allocation without clear property rights and a democratic voting system. So how can we expect the low-educated local party leader to determine the socially optimal allocation of resources acting only by his own morals? Instead it provides an opportunity for these committees to commit corruption.

The Constitution tries to provide the basic rule, stating that water areas and water flows are owned by the state and land is owned either by the state or by the collective. In addition, party documents have more or less functioned as an informal judicial basis. For instance, the stipulations in the Sixty Articles have provided the minimum rules needed for a uniform and rather comprehensive planning of land and water resources and unimodal rural development (Sixty Articles, 1962). It seems as if this informal system for conflict solution has on the whole been satisfactory as long as the Chinese leaders and people are united. However, it is inherent in any modernization process that the complexities of society will increase. Due to this complexity, new types of disputes and conflicts will arise, which no local leader can solve on an informal basis. The weaknesses in the informal judicial system were clearly shown during the Cultural Revolution, when conflict resolution degenerated into widespread commandism and political turmoil. The party leadership seems to have learned its lesson from these years and has started extensive work to construct a legal system of laws and regulations. Article 18 of China's Environmental Protection Law specifies "in case where the discharge of pollutants exceeds the limit set by the state, a compensation fee shall be charged according to the quantities and concentration of the compensation of the pollutants released." A few areas

began experimental implementation of the compensation fee, or pollution levy, shortly after the passage of this law in 1979 (three years after the Cultural Revolution).

Citizen complaints as environmental indicators

In 1982, after 3 years of experimental implementation, China's State Council began nationwide implementation of the Environmental Protection Law by issuing the "Provisional Regulations for Collection of Compensation Fees for Pollutant Discharge." In practice, the Chinese regulators realize that they are ill informed about pollution problems because monitoring is costly. To fill the gap, they solicit complaints from citizens or communities damaged by pollution. This mixed approach may be particularly important in China, where monitoring resources are scare. To compensate, pollution control agencies often focus their resources on responding to citizen complaints. Nowadays, China's provincial and local regulators respond annually to more than 100,000 citizen complaints.

Complaints are undoubtedly a source of low-cost information, since pollution facilities are often apparent to their neighbors even if they are invisible to government agencies. However, there are good reasons for skepticism about complaint-driven resource allocation. Plaintiffs may lack sufficient information to distinguish between 'nuisance' emissions and those that are truly hazardous. Colorless, odorless toxics and heavy metals may escape notice altogether. Furthermore, some individuals or communities may have higher propensities to complain than others, regardless of the objective situation. If regulators respond passively to complaints, aggressive plaintiffs may capture most of the available resources. At last, the utilities of complaint are

heterogeneous across the country. People's expected utility from complaining depends on three factors: the expected pollution reduction from agency action, the value of this reduction (a function of income, existing pollution levels and perception of the risk), and the individual's understanding of the problem (which hypothesize to be a function of education). The unit cost of a complaint is the opportunity cost of the individual's time (proxied by income).

In this section I will employ the model developed by Susmita Dasgupta and David Wheeler (1996), to illustrate the effects of education and income level on the number of environmental complaints. The model is following:

$$\text{Log } Cr^* = \lambda_0 + \lambda_1 \log [Wc\text{r} / Tr] + \lambda_2 \log Er + \lambda_3 \log Yr + \in$$

Where

Cr^* = Environnemental complaintes per 10,000 population

Wc = Total waterborne COD (chemical oxygen demand) emissions

Tr = Provincial area

Er = Provincial literacy rate

Yr = Provincial real consumption per capita (the best available proxy for income)

$\in$ = A random error term

The empirical analysis in this section is provided by a constructed province-level panel database from official yearbooks available in China: The China Environment Yearbook (1987- 1993) and China Statistical Yearbook (1987-1993). After the regression process, the results are shown in the table below:

Period	Dependent Variable		log [Wcr /Tr]	log E	log Y	No. of Obs.	Adjusted $R2$
1987-1993	Log C	Coef	0.04	1.67*	0.42*	203	0.73
		t	0.72	2.53	2.11		

*Significant at 5%

The results show that the estimated income and education effect are both positive and highly significant. Should citizen complaints guide regulatory resource allocation? On the positive side of the ledger, the results suggest that the incidence of complaints is positively related to willingness-to-pay for environmental improvement. The implied income-elasticity of demand in the econometric result is greater than 1.42 (Dasgupta and Wheeler, 1996): As income rises, people complain more even though the opportunity cost of time rises proportionately with income. This result suggests that complaints are a significantly biased index of environmental damage.

Another cautionary note is introduced by the results for education. Provinces with relatively low literacy rates have significantly lower propensities to complain about pollution (ceteris paribus). Undoubtedly, part of this effect has to do with lack of information: Citizens with little or no formal education may not understand the harmful effects of pollutants. However, illiteracy may also have an important 'silencing' effect because people with little formal education have no confidence in their ability to influence the authorities. In either case, the education effect significantly reduces the value of complaints as a resource allocation signal to the regulator.

China's environmental regulators respond to over 100,000 citizen complaints per year. The complaints process undoubtedly provides some useful monitoring information, and an important avenue of community participation in environmental policy. However, it also directs a major share of China's inspection resource toward areas where individuals or communities have a high propensity to complain.

Unfortunately, the results suggest that the resulting allocation is subject to significant bias from a social welfare perspective. I find that the incidence of complaints reflects abatement benefits and the intensity of exposure to highly visible pollutants. However, citizen complaints do not seem to be affected by harmful pollutants that are less visible. Furthermore, the results suggest that basic education has a strong, independent effect on the propensity to complain. Reliance on complaints alone would result in inappropriately low allocation of inspection resources to less-educated, relatively 'silent' regions.

Corruption affects the optimal allocation

By its solvent properties and sequential use characteristic, only rarely is water fully consumed by any particular user. The "return flow" from upstream users may be reduced in quantity and degraded in quality. For example, if there is a chemical factory upstream that discharges chemical waste, fishing industries downstream may be harmed.

Generally, imposing a tax on the polluter or set pollution standards for the polluting industries can eliminate the negative externality. But as mentioned above, the local party committees had absolute power over the implementation of the Environmental Protection Law. This provides for a great corruption opportunity through issuing permits to polluters. The revenues from selling pollution quotas are rarely used for environmental improvement but are instead usually swallowed by the corrupt officials. In addition those emission quotas are untransferable in the market, which means once the polluters obtain the quota they will enjoy monopoly power in the market. The residents living in the polluted area bear the high proportion of environmental costs leaving a major portion of

benefits to those polluting monopolists. These residents would have reduced incomes as a result of corruption.

Political considerations of the central government

The top industrial polluters in China, which are mostly large and medium size states owned enterprises (SOEs) include: metal mining and preparation, coal mining, and textiles. The state owned plants are more pollution intensive than other facilities. First, SOEs may simply generate more waste residuals per unit of output because they are less efficient. By the statistics from the World Bank, China's inefficient SOEs use 20 times the amount of water that Western factories use to produce one ton of steel (Wang and Lall, 1997). Secondly, soft budget constraints may make them less sensitive to pollution levies. Finally, evidence from other Asian countries suggests that SOE factories resist regulation more successfully that privately owned plants (Pargal and Wheeler, 1996)). The research of Dasgupta, Wang and Wheeler (1997) has provided strong evidence in support of this argument. After controlled the sectoral differences in pollution intensity and plan size, their estimation equation for the cross-provincial data set is as follows (for the rth province):

$$\log CODI_r = \alpha_0 + \sum \alpha_{1k} s_{kr} + \alpha_L LARGE_r + \alpha_G STATE_r + \alpha_p \log PLW_r + \varepsilon_r$$

Prior expectations: $\alpha_L < 0,\ \alpha_G > 0,\ \alpha_p < 0$

Where

CODI = COD intensity (COD discharge / Industrial output)

s_{kr} = The industrial output share of the kth sector

$LARGE_r$ = The industrial output share of large plants

$STATE_r$ = The industrial output share of state-owned plants

PLW_r = Effective pollution levy per unit of excess wastewater discharge

ε_r = A stochastic error term incorporating provincial components

The estimated coefficient of state enterprise share in the model (α_G) is 1.832 and the t-ratio is 2.726, meaning that the SOEs are substantially more pollution-intensive than other plants in China. SOEs' insulation from regulation is the contributing factor of the result. Why can SOEs insulate themselves from regulation? It's simply because more than half of the payroll in China is held by SOE, and unemployment is a sensitive political issue that the Chinese government does not want to see. However, SOEs are inefficient but they are labor intensive on the other hand. Thus, the government has to soften the regulation for SOEs, to prevent them from balancing the books by laying off people. Further more, the government subsidizes the SOEs by lowering the price of water supply and subsidizing the wastewater treatment service. Actually these subsidy policies lead to excess demand, high pollution, and inadequate funds to meet investment.

The World Bank's data shows in 1997 the real average marginal values for the whole industry at 2.45 Yuan per cubic meter, which is a very low estimation. However, these numbers contrast with the current practice of water pricing in China, which is in the range of 0.70 to 1.20 Yuan (World Bank, 1997). Even after two price rises in 1999, water price in Beijing at 1.30 Yuan per cubic meter for residents use and 1.60 Yuan for industrial users, are still below the average marginal values. By the substitution effect in the production function, companies induced to choose the technologies that use more water as an input of production to replace the relatively expensive capital (Cobb and Douglas, 1928). In the light of these results, it would not be unreasonable for water utilities to increase prices, as the marginal values are reflective of the willingness to pay for service. Further the estimated price elasticity of water demand is about –1.0 (which

means the total revenues would not decrease as the government raises the price of water), suggesting that pricing policies can be a potential instrument for water conservation (Wang and Lall, 1997). In addition, numerous of studies suggest that levy rates are below the marginal cost of abatement needed for compliance with Chinese emissions standards. Therefore, equilibrium pollution in China is not optimum pollution. Drawing on this evidence, some critics have asserted that the levy as a local financing mechanism which is ineffective as a regulatory instrument. (Qu, 1991; NEPA, 1992 and 1994; Shibli and Markandya, 1995)

Conclusion

The water use per capita in China is 2,300 cubic meters, the 88th place among all countries and equivalent to only 30 percent of the world average volume. A recent report from the Chinese Academy of Sciences predicted that water demand in China will grow by 60 percent over the next half century and this will help enhance the growing awareness of the seriousness of China's water situation. Undoubtedly, the Chinese authority has put much of effort towards the water project constructions, which play an important role on stabilize water supply and control floods. However, water pollution and uneven distribution of water resource are still chronic problems in China. It is time for them to solve the problem by using the principle of economic efficiency.

In conclusion, my analysis provides a number of suggestions for water development in China:

· Privatizing all the water-use rights may not be the optimal solution. However, the constitution definitely should clarify who, when, where, and how to use the water

resources. Once the usage rules have been established, the parties involved will reach an efficient solution by bargaining among themselves. Also, moving to a market oriented system of water allocation can lead to greater water conservation. A major goal of water reform is to make water transfers legal and to lower the transactions costs associated with water transfers.

- An independent agent should be authorized to oversee the implement and enforcement of the Environmental Protection Law, In order to eliminate the opportunities of corruption of the local party committee. Furthermore, the independent agent could prevent the informal judgement in the rural regions.
- Reliance on complaints would result in inappropriately low allocation of inspection resources to less educated, relatively 'silent' regions. The results also suggest that basic education has a strong effect on bargaining power. The education is necessary to unmask the traditional myths and beliefs in water perception including the mighty River Dragon King, thereby paving the way for a modern use and care of water. In addition, due to low literacy rate, the value placed upon health damage by pollution is inappropriately low. Inaction amounts to valuing a Chinese worker's life at less than $US 500, a figure which is tragically low by any standard.
- The price of water in China is lower than both the real average marginal values for the whole industry and the costs of delivery, maintenance, management and operation. On the other hand, levy rates are below the marginal cost of abatement needed for compliance with Chinese emissions standards. My results suggest that a correct pricing and levying policy could be a potential instrument for water conservation and protection.

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