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Remuneration of Positive Externalities (RPE)/ Payments for Environmental Services (PES)

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As part of the efforts of China to establish eco-compensation mechanisms at multiple scales, the pilot project of Compensation for Water Environment of the Xin'an River has set a good example of reaching an agreement between downstream and upstream provinces by means of negotiations and using a carrot-and-stick mechanism to ensure the conditionality of the payment scheme.

Policy Experiment of Trans-boundary Watershed Management of the Xin'an River in China

Overview

China's astonishing economic growth in the past three decades has come with heavy environmental cost. Taking water environment as an example, over 40% of its rivers are seriously polluted and 80% of its lakes are suffering from eutrophication [1]. In addition to the conventional countermeasures of enacting environmental protection laws and levying pollution discharge fees, China has been exploring innovative policy instruments to tackle with its environmental problems. In recent years, most attention and efforts have been focusing on the policy instrument of *Ecological Compensation* (eco-compensation), the Chinese version of *Payment for Environmental Services* (PES) which compensates people for protecting the natural environment. Since the late 1990s, the Chinese central government has launched some of the largest environmental services payments schemes in the world such as the national-scale Sloping Land Conversion Program (also known as Grain to Green Program) which compensates rural households for converting sloping croplands into forests or grasslands to reduce soil erosion in the upstream regions of the Yangtze and Yellow River [2].

Encouraged by the central government's promotion of establishing eco-compensation mechanisms at multiple scales around the country and urged by the local needs for securing the provision of clean water against deteriorating environment, some local-scale payment schemes for watershed services have also been implemented by individual provinces [2]. However, compensation for trans-provincial watershed management has long been a difficult issue because of the disputes and poor coordination between the upstream and downstream provinces. Besides, similar to many PES programs in other countries, the existing eco-compensation schemes in China often suffer from a lack of conditionality (i.e. providers of environmental services can receive payments if and only if they secure the provision of the service) due to loose monitoring and weak sanction for failing in providing the contracted services [3, 4].

The pilot project of *Compensation for Water Environment of the Xin'an River* is a breakthrough in China's policy experiment in trans-provincial watershed management. Under the mediation of the Chinese central government, the upstream Anhui Province and downstream Zhejiang Province reached an agreement by means of negotiations. Using a "carrot and stick" payment scheme based on a clearly defined water quality baseline, this project integrates the principles of "Beneficiary Pays" and "Polluter Pays" to ensure the conditionality of the payment. Direct assessment of the water quality not only enhances the effectiveness of this project, but also gives the downstream province the important flexibility to adopt both conservation practices and pollution abatement technologies to achieve the project's target. So far, the total funds of this pilot project have amounted to US\$120 million [5].

Background

The Xin'an River originates from the prefecture of Huangshan City (green bubble in Figure 1) in Anhui Province and flows 359 km with a catchment of 11,674 km² into the Qiandao Lake (blue bubble), which covers 573 km² and is a vital drinking water source of Zhejiang Province, particularly the provincial capital, Hangzhou City (red bubble) in Eastern China [2]. As two thirds of the Xin'an River and over a half of the river catchment is in Anhui Province, the river runoff accounts for over 60% of the total water inflow of the Qiandao Lake [6]. Therefore, watershed management in the upstream Anhui Province is crucial to the water quality of the Qiandao Lake, and consequently to the drinking water security of the downstream Zhejiang Province.

It has been more than a decade for an agreement reached by the two provinces on a trans-provincial payment scheme for watershed management. After the first outbreak of blue algae in part of the Qiandao Lake in 1998, representatives of the Zhejiang Province submitted a proposal during the National People's Congress (NPC), the highest legislative body in China, in 1999, asking the upstream Anhui Province to better clean floating rubbish in the Xin'an River. But in the next year's NPC, representatives of Anhui Province suggested that water pollution control of the Xin'an River should be included in the central government's total plan, which implied a request for financial support from the central government. Later in 2001, the former National Environmental Protection Bureau (which was upgraded to the Ministry of Environmental Protection in 2008) organized the first coordination meeting between the two provinces, but no progress was made [7].



Figure 1 The Xin'an River and Qiandao Lake in Eastern China (adapted from Google Maps)

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Rationale

The economic disparity between the two provinces has been substantial. The GDP per capita of Huangshan City in the Anhui Province (where most people in the upstream region live) is less than one third of the level of Hangzhou City (the provincial capital city of the downstream Zhejiang Province, relying on the Qiandao Lake as the main source of water supply). The annual personal income of residents in Huangshan City is only about half of the income level of the residents in Hangzhou City [7]. Therefore, people in Anhui Province have strong desire to improve their livelihoods through economic growth. They felt that it was unfair to expect them to assume the costs and accept the forgone economic opportunities of protecting the river while the more affluent people in the downstream province would enjoy the fruits of their efforts to improve watershed services. However, people in Zhejiang Province argued that they already handed over US\$16 billion (about half of the province's total revenue) to the central government each year, so it should be the central government who compensate Anhui Province for watershed management [3]. From an institutional point of view, although there had been some local compensation schemes for water protection within Zhejiang Province, inter-provincial payment mechanism did not exist at that time in China.

With the growing pollution threat to the Xin'an River and the Qiandao Lake, there was a urgent need for an innovative policy instrument for protecting trans-provincial rivers. This attracted considerable attention by the central government, particularly during 2005-2007 when a member of the NPC's Environment and Resources Committee member consecutively submitted the proposal of designating the Xin'an River Basin as a national demonstration region for trans-provincial watershed management scheme in which the downstream province could have clean river water while the upstream province could receive reasonable compensation for its economic loss for protecting the river. With the significant progress on the design and implementation of eco-compensation schemes around in China, in 2007, the Ministry of Finance and the former National Environmental Protection Bureau jointly announced the Xin'an River Basin as the demonstration region for the first pilot project of ecological compensation for trans-provincial watershed management in the country.

However, the two provinces were still far from reaching an agreement. The downstream Zhejiang Province insisted that it had no obligation to compensate the upstream province if the river's water quality could not be guaranteed, while the upstream Anhui Province demanded for some room for possible increase in pollution concentration in view of future economic development. Specific and important details such as how to monitor and assess the water quality were also focal points in the negotiations. In order to encourage the two provinces to participate in the project, the Ministry of Finance allocated US\$8 million in 2010 and US\$32 million in 2011 to Anhui Province as start-up funds [8].

Finally in September 2011, under the mediation of the central government, the two provinces agreed on the basic plan of implementing the pilot project entitled *Compensation for Water Environment of the Xin'an River*. In January 2012, the environmental monitoring departments from the two provinces conducted the first joint monthly water sampling at the boundary river section, which signified the commencement of this pilot project [9].

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The market for the provision of environmental services

Provider, beneficiary and intermediary

The pilot project of *Compensation for Water Environment of the Xin'an River* consists of agreed payments for a provisional term of 3 years since 2012 between the provincial governments of upstream Anhui, downstream Zhejiang and the Chinese central government. The environmental service provided and bought in this project is watershed management focusing on water quality. The provincial government of Anhui representing the upstream residents is the provider of the environment service, while the provincial government of Zhejiang representing the downstream residents is the beneficiary of clean water. The central government (mainly the Ministry of Finance and the Ministry of Environmental Protection) plays a dual role in this project. Firstly, it represents all the people in the country who directly or indirectly benefit from a clean river and provides a large portion of the project funds. Secondly, the central government plays the role of an intermediary between the upstream and downstream provinces during both project design and implementation.

Payment agreement and service measurement

One of the most innovative aspects of this project is that the payment between the upstream and downstream provinces is directly dependent on the water quality at the boundary river section [10]. A payment parameter (P) is calculated to assess the water quality and determine the payment. The parameter i ranging from 1 to 4 refer to four water quality indices that are monitored in this project, including the permanganate index, ammonia nitrogen, total nitrogen and total phosphorus. C_i is the average concentration of the water quality index which is monitored at the boundary river section in each agreement year. C_{i0} is the baseline of the water quality index, namely the average pollutant concentration during 2008-2010. W_i is the weight of each water quality index which is equal to 0.25. Interestingly, a water quality stability parameter, S, which is equal to 0.85 is introduced in the assessment formula to allow for possible increased pollution concentration caused by acute changes of natural conditions such as rainfall.

If the river water quality is maintained at least at the required level, namely $P \leq 1$, the downstream Zhejiang Province would pay the upstream Anhui Province US\$16 million per year as a reward.

Otherwise, if the water quality has not been met the required level, namely $P > 1$, the upstream Anhui Province would pay the same amount of money to the downstream Zhejiang Province as a penalty.

In either case, the central government allocates US\$ 48 million per year to Anhui Province for flexibly adopting both conservation practices and pollution abatement technologies to ensure the water quality. In addition, the provincial government of Anhui would also pay US\$16 per year to the upstream region (mainly to the prefecture of Huangshan City) for watershed protection (see Figure 2).

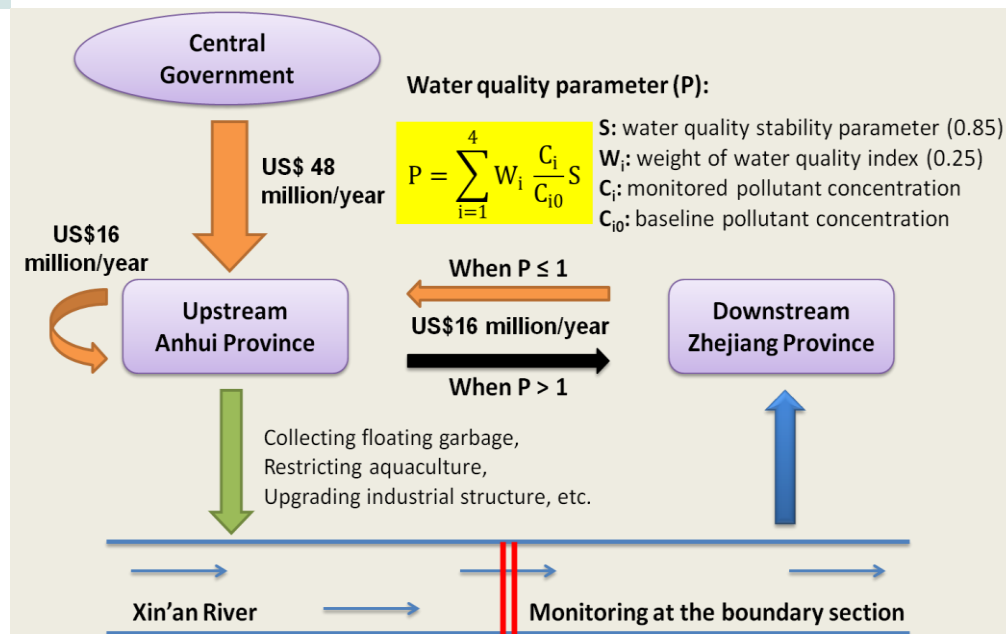


Figure 2 Payment Agreement and Service Measurement of the Trans-provincial Watershed Management Project for Xin'an River

Payment agreement and service measurement

This carrot-and-stick mechanism based on a clearly defined service baseline of water quality helps to ensure the conditionality of the payment scheme by integrating the Principle of Beneficiaries Pay and the Principle of Polluters Pay [11]. It is more acceptable to the downstream province than commonly adopted PES schemes which only involve raising money from beneficiaries and fall short of sanctions against the failure of providing the environmental services.

Because of the introduction of the water quality stability parameter ($S = 0.85$), when P is equal to 1, the ratio between the monitored pollutants concentration and baseline concentration is about 1.18. In other words, the upstream province can still receive payment from the downstream province even if there is a maximum of 18% increase in pollutants concentration. Although this water quality stability parameter is stated to be a consideration for potential changes in natural conditions, it also allows some room for possible increased pollution which may be caused by future economic development in the upstream region. This may not be a stringent payment condition, but it is the result of a compromise in years of negotiation between the two provinces.

Monitoring

Since the payment between the upstream and downstream provinces is dependent on the result of water quality assessment, monitoring of water quality is a crucial part in this project to provide necessary data to determine the payment. A detailed water monitoring plan has been formulated by the National Environmental Monitoring Centre (NEMC) affiliated to the Ministry of Environmental Protection [10]. As in this plan, water sampling is jointly conducted at the boundary river section on a monthly basis under the coordination of the NEMC. Each collected water sample is split into two sub-samples to be analysed by the two provinces individually, and the average of the two results is used for water quality assessment. If the two provinces have any dispute on the monitoring data, it is for the NEMC to make the final arbitration. In practice, ever since October 2012, the two provinces have further collaborated to jointly collect water samples and analyse water samples. In addition to the monthly manual monitoring, a national automatic water quality monitoring station at the same river section (operated by Zhejiang Province) provides reference data six times per day.

Watershed management measures in Anhui Province

Unlike the contracts of many PES schemes which are signed for undertaking specific practices that are supposed to secure the desired environmental services, the agreement of this project is directly geared to the environmental service itself, namely the water quality. This has given Anhui Province the flexibility to adopt necessary watershed management measures, inter alia including cleaning up garbage floating on the river, building waste treatment facilities in rural areas, restricting aquaculture and upgrading industrial structure by closing high-pollution factories and investing low-pollution industrials [5]. As estimated by the Anhui Province, the investment needed for an integrated water pollution control scheme (independently planned by Anhui) for the Xin'an River will amount to US\$6.4 billion in 3-5 years. In addition to the funds from this pilot project, the China Development Bank affiliated to the central government has agreed to provide a loan of US\$3.2 billion to Anhui Province [12].

The upstream province can receive a large portion of funds from the central government (US\$48 million per year) irrespective of the result of water quality assessment (the value of the payment parameter, P), which to some extent undermines the conditionality of the payment scheme.

Nevertheless, it is the response from the central government to the two provinces' requests for financial support for watershed protection. In fact, this may be one of the major reasons why the two provinces agree to participate in this pilot project.

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Lessons learned

The pilot project of Compensation for Water Environment of the Xin'an River Basin is a breakthrough in China's struggle in trans-provincial watershed management. For the first time, this project has established a payment scheme between the upstream and downstream provinces by means of negotiation. The innovative features of this project can be valuable lessons for other similar schemes in terms of (1) the carrot-and-stick mechanism to ensure the project's conditionality and integrating the Beneficiary Pay Principle and the Polluter Pays Principle, (2) the clearly defined baseline to determine whether the reward or the penalty should be applied (3) the introduction of the stability parameter for allowing a certain degree of fluctuation in water quality, and (4) the joint water quality monitoring at the boundary river section to directly measure the environmental service (water quality). These innovative features have generally balanced the competing interests of the two provinces, which can be attributed to the disputes and compromise in years of negotiation and the fact that from the political perspective, the two provincial governments in the negotiation have equal power. Therefore, the negotiation strategy of having stakeholders with equal power is useful to avoid unfair distributional effects due to unbalanced political power of providers and beneficiaries in PES schemes.

This project has also demonstrated the central government's vital role in designing and implementing trans-boundary watershed management. Mediation provided by the central government has been a key to draw the two provinces into negotiations, and the financial support offered by the central government is one of the major reasons for the two provinces to reach an agreement in this project. Besides, technical departments affiliated to the central governments can also be the organizers of monitoring environmental services and arbitrators in addressing controversies. Policy embeddedness is therefore crucial in this PES scheme.

Despite all these innovative features, further improvement and adjustment are needed in this pilot project. Both provinces are not totally satisfied with the current agreement. The downstream Zhejiang Province is not content with the introduction of the water quality stability parameter which is set to 0.85 and asks for more stringent payment conditions. From the perspective of the upstream Anhui Province, the compensation received from the downstream province and the central government are insufficient to cover the costs of water protection measures, and they do not cover the opportunity costs of restricting industrial development in the upstream region. Therefore, it requests more compensation funds and other forms of compensation such as private investment from Zhejiang Province to foster low-pollution industries in the upstream region for improving local livelihoods. Besides, limited attention has been given to the implementation of the project at household level and the impacts on the livelihoods of people in Anhui Province.

After the launch of this pilot project, proposals of similar projects have been actively discussed for other rivers in China. Although it is too early to claim the success of this project at present, it is worthwhile to keep an eye on its progress in the future. Experience gained from this project not only is useful to the watershed management of trans-provincial rivers within China, but also can be applied to trans-boundary international rivers around the world.

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