Private participation in China's wastewater service under the constraint of charge rate reform

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Abstract China is moving towards a market-based economic system, which includes the water sector. The state is emphasizing tariff reform of the water sector, which is a necessary step in the transition to a market economy, and also an important step for China's wastewater management. With the gradual increase of wastewater service charges, more private investment is attracted to participate, which leads to a decrease in the proportion of direct public investment. This paper develops a model to quantitatively analyse the dependence of private investment on the scale of public investment at different rate levels of wastewater treatment charge. In the meantime, the impacts caused by tax policies on rate level and private sector participation are analysed. In terms of the survey regarding the marketization reform process of the wastewater sector, a summary of the current major public–private partnership (PPP) approaches in China is given in this paper, which reveals that the strategy option also depends on the rate level of the wastewater treatment charge. As a consequence, the government has to keep a greater investment ratio to initiate the market and induct private investment, particularly because the current WWTC rate is at a low level. Furthermore, the BOT-type option is, and still, could be a major form of PPP in China for a while due to the constraint of the current low rate level of the wastewater treatment charge.

Keywords Charge rate; charge reform; public investment; public–private partnership (PPP); wastewater service charge

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Introduction

Over the past two decades China has been moving towards a market-based economic system. In recent years, the so-called 'marketization reform' has been implemented widely in the water utility sector, which includes organizational change of water service providers, introduction of competition, private sector participation, a new governance structure, etc. (Zhong, 2005). The state is increasingly institutionalized to withdraw from the daily business of water service and create business opportunities for private corporations. During this reform process, the water tariff reform has been of critical importance, mostly due to the huge demand for investment. By the end of 2004, China had built 708 wastewater treatment plants (WWTPs) with a total capacity of 4.9×10^7 m^3/day, and treating about 45.67% of national urban municipal wastewater (excluding townships) (MOC, 2005a, b). But this treatment capacity is far from adequate to control the increasing water pollution problem in China. It is estimated that the demand for direct investment in the urban wastewater infrastructure (including the cost for wastewater treatment, sewers, and sludge treatment) in China is expected to be over 30 billion US dollars between 2006 and 2010.

A tariff is the system of procedures and elements that determines a customer's total water bill (any part of that bill is called a charge). In China, the water tariff comprises of

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four parts, i.e. the water resources charge, the charge for water engineering (e.g. the construction of water reservoirs), the water supply price, and the wastewater treatment charge (WWTC) (General Office of the State Council of China, 2004). In China before the 1980s; however, water and wastewater services traditionally had been provided as a public utility almost free of charge. In the late 1990s, a number of cities were requested by the central government to collect WWTCs to raise funds for constructing wastewater treatment facilities. In 2002, the Chinese Government initialized the charge reform with emphasis on increasing charge rates in order to satisfy the needs of constructing a new wastewater infrastructure. Up to now, 475 of a total 661 cities have collected the WWTC. However, the current charge system of the wastewater sector is only at its starting point and is far from the reform goals. Water tariff reform includes substantial changes to the water sector, not only in tariff formulation and levels, but also in water regulation, business environment, financial approaches, subsidies, and public regulation.

This paper is directed towards discussions of the dependence of private participation on the reform of the wastewater charge system in China. In the next section, we will illustrate first the quantitative impacts of public investments on the possible return to a private cooperation under different wastewater charge rates based upon a developed cost analysis model. The impacts of tax policy and government subsidies on private participation are also discussed. This is followed by a discussion on the types of PPP in China and their reliance on the available financial mechanisms and the charge reform of the wastewater sector followed by the conclusion.

The dependence of private participation on public investments

The wastewater sector in China is currently not only under rapid development but also is in a transit phase. With the gradual increase of wastewater service charges, more private investments are attracted to participate, which leads to a decrease in the proportion of direct public investment. To achieve the targeted construction level of the wastewater infrastructures, the government needs to keep a good balance between the increase in the wastewater service charge and public investments so that the rate of increase is not too high to be accommodated by residents. In this section, a conceptual model is developed to assess the relationship between public investment, wastewater service charges, and the capacity of private participation, the details of which are given below.

When a private corporation invests in WWTPs, an investment return IY_c is expected, as given below, i.e.

$$IY_c = I \times (1 - r_g) \times RY_c \tag{1}$$

in which I is the total investment in the newly increased treatment capacity of WWTPs and the rate for treating unit volume of wastewater i is 1486.416 RMB/m^3 (MOC, 2001); $r_g (0 \leq r_g \leq 1)$ is the public investment ratio; $RY_c (0 < RY_c \leq 1)$ is the expected investment return rate, and its current value is 8–12% in China. In this study, RY_c is assumed as 10%.

The return to public investment Y can then be given as

$$Y = V_n \times [p_{ww}(1 - r_{t1}) - C] \times (1 - r_{t2}) \times 365 - I \times (1 - r_g) \times RY_c \tag{2}$$

in which V_n is the newly increased daily capacities of WWTP in 10 000 m^3 per day; p_{ww} is the WWTC rate in RMB/m^3; r_{t1} is the sale tax rate at 5.5%; r_{t2} is the income tax rate at 33%; C is either the operational or full cost of WWTPs, and their values are 0.411772 RMB/m^3 and 0.563888 RMB/m^3, respectively, in this study (MOC, 2001).

If we assume the government invests in the wastewater service as public goods and has no requirement on investment return ($RY_c = 0$), we can have

$$p_{ww} = \frac{\frac{i\times(1-r_g)\times RY_c}{(1-r_{t2})\times 365} + C}{1 - r_{t1}} \tag{3}$$

or

$$r_g = 1 - \frac{[p_{ww} \times (1 - r_{t1}) - C] \times (1 - r_{t2}) \times 365}{i \times RY_c} \tag{4}$$

Furthermore, if we assume that the government could implement a tax–free policy to the wastewater sector (i.e. $r_{t1} = 0$; $r_{t2} = 0$), then Equations (3) and (4) can be simplified as

$$p_{ww} = \frac{i \times (1 - r_g) \times RY_c}{365} + C \tag{5}$$

$$r_g = 1 - \frac{(p_{ww} - C) \times 365}{i \times RY_c} \tag{6}$$

Based upon Equations (3) to (6), the relationships between the WWTC rate and the required proportion of public investments are shown in Figure 1. The results reveal that the WWTC rate should be set at 0.819 RMB/m^3 and 1.079 RMB/m^3, respectively, in the case of taxes being excluded or included based on the operational cost, and the WWTC rate should be set at 0.971 RMB/m^3 and 1.240 RMB/m^3, respectively, in the case of taxes being excluded or included based on the full cost, if public investment were not injected into the wastewater sector. Note that the current average WWTC rate is only 0.490 RMB/m^3 in China, based on the charge information from 27 metropolises, which are in fact of a comparatively higher WWTC rate than other cities. The current WWTC rate in China requires a very high ratio of public investment (at least 80% in all cases) if wastewater treatment infrastructures are constructed and operated. In other words, the current WWTC rate in China is too low to form a large volume of the wastewater financial market. The incentives to promote private participation thus rely considerably upon financial input from the government. Furthermore, we can say that the increase in the WWTC rate has been the bottleneck in reforming the wastewater sector in China.

As the incentives to promote private participation rely considerably upon financial input from the government, Figure 2 shows the required ratio of public investment in the capital metropolises of 27 provinces in China under their current WWTC rates, if private investment could be attracted. Again, only in the case of taxes being excluded, two cities (i.e. Beijing and Shanghai) are eligible for full private participation based upon operational costs. In other cases in terms of both taxes and a full cost recovery, all the cities require certain public investment to start up the water financial market. If a lower WWTC rate is applied, higher public investment is required; and the ratio of public investment exceeds 100% if the WWTC rate is less than the cost. The high ratios of the required public investment across all these metropolises indicate that private participation is widely limited by the wastewater charge rate all over China.

Furthermore, tax policies are also important for private participation. As shown in Figure 1, the projected WWTC rate with taxes is approximately 30% higher than without taxes. This means a higher rate level of WWTC is required while taking taxes into account. If higher taxes are paid by the corporation, a higher rate level is required.

It is a fact that the charge reform process of increasing the rate level of WWTC to meet cost-recovery is fairly slow and complicated, because the rate level is also

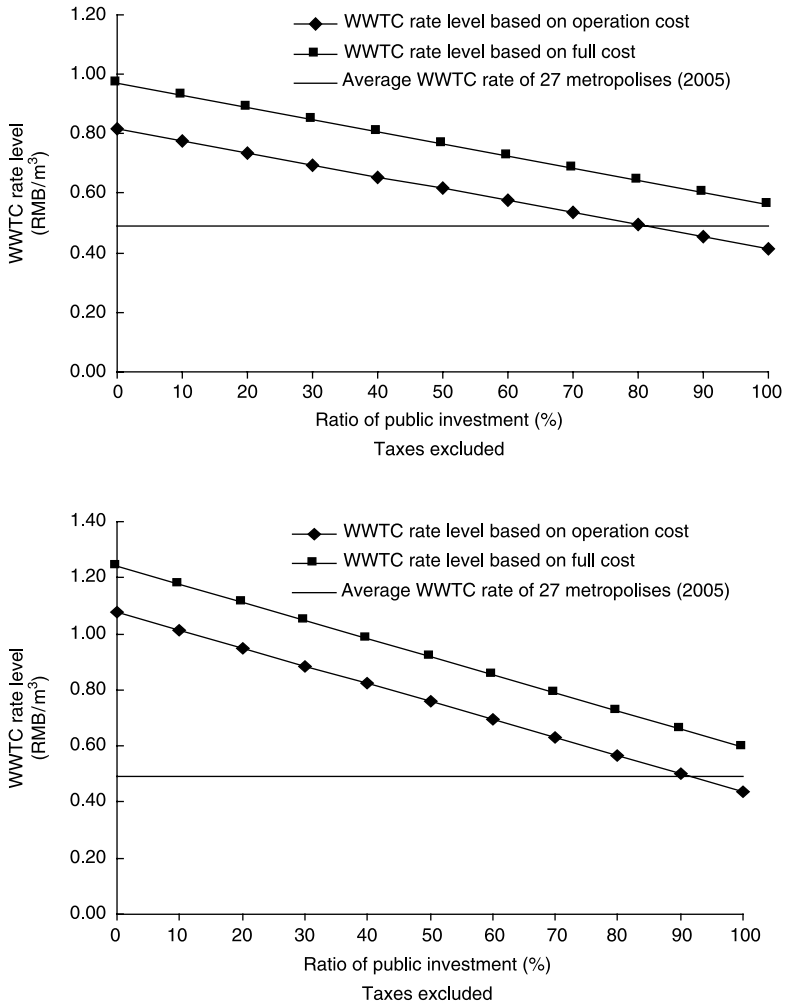

Figure 1 The WWTC rate and the required ratio of public investment

constrained by the acceptability of public and other non-economic factors. Thus, it is essential to take tax policy reform into consideration while implementing the charge reform of wastewater, which can also stimulate private sector participation in the wastewater sector.

Public–private partnerships in China

Rapid economic development and urbanization over the past two decades has led to considerable deterioration of environmental quality in China. The huge demand for the construction of wastewater infrastructures, together with the government's policy of marketizing the wastewater service, has been highly attractive to private' participation. As discussed above, however, the progress of private participation has been limited largely, due to the low WWTC rate.

Although PPP in the water sector has been practised in China for over a decade, it has been only widely accepted since 2003 when the central government formally opened public utilities to the private sector. This progress was further accelerated due to the issues of 'The Administrative Method of Urban Utilities Concession' by the MOC and 'The Decision on the Investment Institution Reform' by the State Council (SC) in 2004.

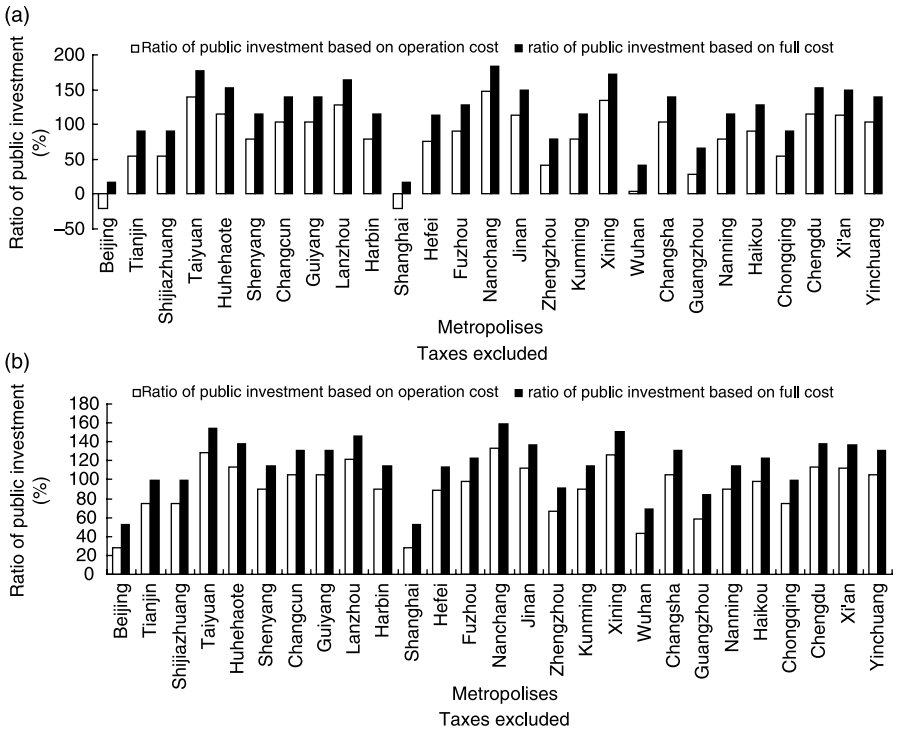

Figure 2 Ratio of public investment at a certain WWTC rate

According to the latest survey, 184 of 274 investigated facilities at the municipal level have applied PPP (MOC, 2005a, b). Figure 3 summarizes the major types of PPP applied in China, among which the build–operate–transfer (BOT) type is dominant.

The PPP structure above is due mostly to the low WWTC rate. This is because different PPP approaches are of different financial risks, and they could have different reliance on WWTC rates. If a private sector is interested in asset ownership, for instance, it will depend more strongly upon WWTC rates. This could explain why the joint venture type of PPP in China is only at a small percentage in the wastewater sector, much lower than in other industries. On the other hand, however, the wide practice of BOT-type PPP is

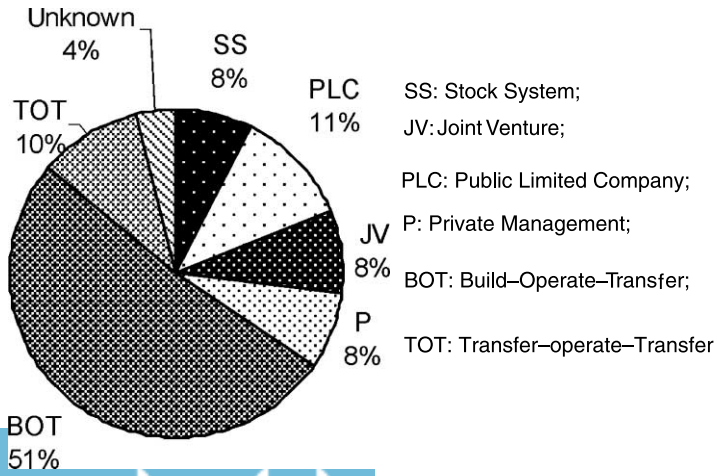

Figure 3 The major PPP types applied in China's wastewater sector

due mostly to its association to a contracting price between the government and corporation, rather than the WWTC rate. In other words, the PPP types in China may be under a considerable constraint to the low WWTC rates, and given the complexity and sensitivity of price reform in China, the BOT type still could be a major form of PPP in China for a while.

Given the fact that the current WWTC rates in China are still at a low level and far from the full-cost, the development of the wastewater sector will rely considerably upon subsidies from government. This is particularly so in regions where the rate of WWTC is at a low level. Different WWTC rates would require different scales of public investment to initialize the wastewater market. Or in other words, for different WWTC rates, a given input from the public would attract different amounts of private investments. This is well illustrated by Figure 4, where the dependence of private investment on the scale of public investment is described with different WWTC rates. As shown by points A and B of this figure, public investment can bring only limited capital from the private sector if the WWTC rate is at a lower level than the operational cost. This means that private sector participation depends considerably on public investment at a lower rate of WWTC. On the other hand, however, points C and D suggest that a low ratio of public investment could ensure much more private capital if the WWTC rate is high enough to cover the

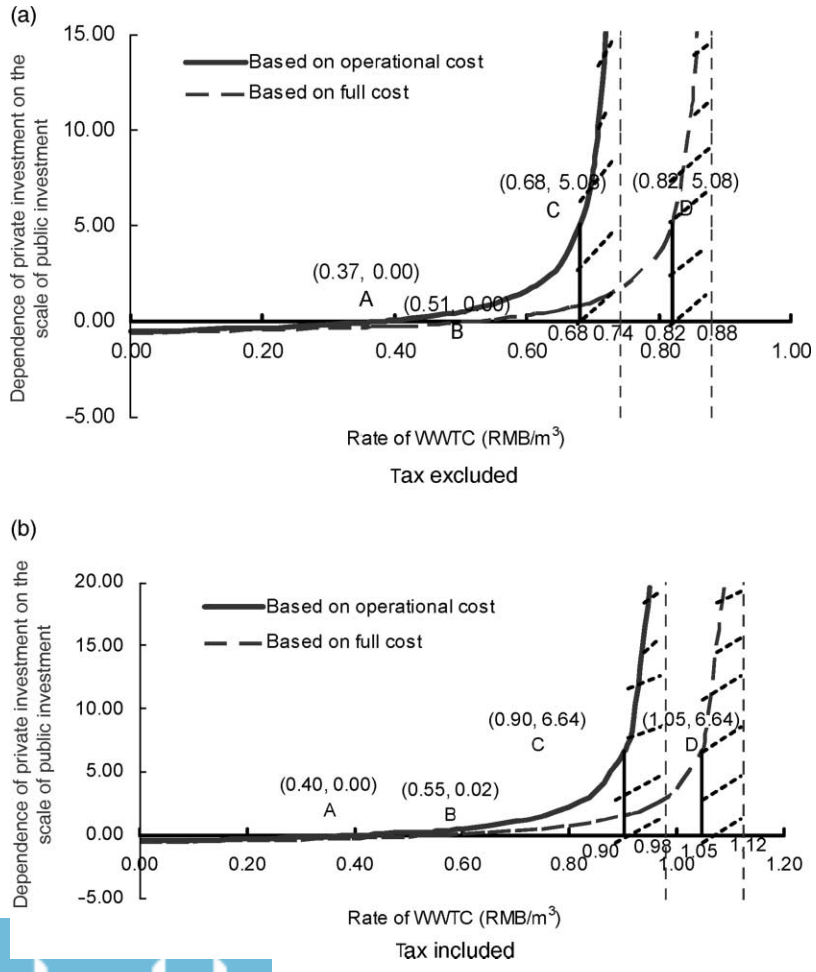

Figure 4 Dependence of private investment on the scale of public investment

Table 1 Percentage of WWTC collection (2003)

Percentage of charge collection	<30%	30–50%	50–70%	70–90%	>90%	Uncertain	Total
Numbers of cities	16	31	56	69	40	113	325
Percentage (%)	4.9	9.5	17.2	21.3	12.3	34.8	100

Note: calculated only for households
(Source: SDRC & MOC, Dec 2003)

full cost. For instance, 1 US dollar invested by public financing cannot bring in any investment from the private sector if the WWTC rate is 0.40 RMB/m^3 (tax included), and can only bring in 0.02 US dollar from the private sector at a WWTC rate of 0.55 RMB/m^3 (tax included); while 1 US dollar of public investment can bring in 6.64 US dollar investment from the private sector at a WWTC rate of 0.90 RMB/m^3 (tax included).

Furthermore, the slow reform process of the water tariff also caused some difficulties for the marketization reform of the wastewater sector. Although charging wastewater services has been vigorously promoted by central government, practical implementation by local government has not been encouraging. Table 1 summarizes the water and wastewater billing percentage in China in 2003. It can be seen that less than 15% of the 325 cities had a collection rate over 90% and about 15% had a collection rate less than 50%.

Conclusions

The charge reform of WWTC is a crucial step for China's wastewater sector management. In conclusion, the charge reform, in particular the increasing rate level of WWTC, has a direct and important impact on the investment structure and marketization reform process of the wastewater sector. As analysed above, private sector participation in the wastewater service sector has a close dependence on the ratio of public investment in the wastewater sector and the rate level of WWTC. The government has to keep a greater investment ratio to initiate the market and induct private investment, particularly because the current WWTC rate is at a low level.

On the other hand, the PPP options in China may be under a considerable constraint to the low WWTC rates, and given the complexity and sensitivity of price reform in China, the BOT type still could be a major form of PPP in China for a while.

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