Water Reform, Private Sector Participation and Child Health in China

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1. Objectives

China undertook market-oriented water reform from early 1990s, in order to finance for urban water infrastructures and tackle inefficiencies of state-owned water utilities. By 2013, almost 40% of the water supply utilities are privatized and 10% state owned enterprises (SOEs) are transformed (NBS Annual Industrial Firm Survey, 2013).

Researchers have found connections between piped water access and better health outcomes. However, whether private sector participation (PSP) can improve health is controversial, especially in high risk areas. Theory literature suggests that PSP can increase utility efficiency if it is accompanied by direct competition, or through a competitive bidding process (Shapiro and Willing, 1990; Schmidt, 1996). In China, the main phase of water reform started from 1993, and this period featured transforming SOEs into modern corporations and privatizing small SOEs, by the policy called 'grasping the large and letting go the small'. The policy meant to maintain the control over the large SOEs and relinquish control over smaller SOEs. Although PSP is encouraged by the government, SOEs still hold monopolies in water supply sector and the coverage of piped water is still the current priority. Private sector participation in water supply is proved to decrease diarrhea and child mortality among under-five children in African and Argentina (Galiani et al., 2005; Kosec, 2014). However, it is not clear whether different type of water reform would effect child health in different ways.

This study investigates the impact of water reform on health outcomes of children under five years of age in rural area of China, focusing on the types of water reform. A repeated cross section dataset of CHNS (China Health and Nutrition Survey), Annual Industrial Firm Surveys from 1999 to 2013 conducted by the National Bureau of Statistics (NBS), World Bank PPI database are used to run the estimation. It is found that private participation decreases the incidence of diarrhea among children aged under five, while the improvement in weight for height and height for age is not observed. Furthermore, the health benefits of water reform are greater for children in rural areas from less educated households.

2. Methodology

Data from CHNS and NBS Annual Industrial Firm Survey are cross-referenced to construct a child level dataset on location of transformed SOEs and PSP in water supply sector between 1989 and 2015. Treatment variable $Waterreform_{jct}$ denotes reform type j in community c at year t. The main health outcome variables H_{ict} are from CHNS, including the incidence of diarrhea in the last four weeks, weight for height and height for age among children under five years of age obtained piped water access. Other health outcome variables, such as general sickness in last four weeks; fever, cough and throat sore in last four week are also collected for placebo analysis. X_{ict} is a vector of individual, household and community variables. Year dummy and city dummy are considered as well to control for

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the time invariant and time varying characteristics. We assume regions with water reform have better piped water access and service, which brings better health outcomes. Based on the data and assumption, the following model was established for the analysis:

$$H_{ict} = \alpha Waterreform_{jct} + Pretreat_{jct} + \gamma X_{ict} + \varepsilon_{ict}$$

Incidence of diarrhea is a binary variable, therefore both Logit models and Probit models are used for the estimation. OLS estimations are used for the analysis of weight for height and height for age. To address the possible endogeneity between water reform and child health, two instrument variables are constructed-altitude of the community and increase rate of urban built-up area.

3. Main Results

Table 1 reports the estimation results from Logit, Probit and IV probit models. Water reform shows significantly negative impact on the incidence of diarrhea. The coefficients are similar and robust for Logit and Probit models. In light to Wald test, specification in normal Probit models are more efficient with lower standard error compared to IVprobit models. Column (3), (4), (6) show that PSP has a greater impact by decreasing about 10.8% in the possibility of diarrhea attack than SOE transforming. For the placebo test, we construct several subgroups of water-unrelated diseases, and we estimate the effect of PSP in other sectors as well. These results imply that PSP in water supply has no effect on the reduce of respiratory disease and PSP in other sectors are not effective in reducing diarrhea. We also estimated the impact of water reform on weight for height and height for age, although the results does not show statistically significant effect.

Tab.1 Effect of water reform on the prevalence of diarrhea among children under five years of age in rural area

	Logit	Logit	Logit	Logit	Probit	Probit	IVprobit	IVprobit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Water reform	-0.085***	-0.077***			-0.083***		-0.065	
	(0.029)	(0.026)			(0.025)		(0.172)	
Treatment	0.061***	0.051**			0.057**		0.043	
	(0.017)	(0.025)			(0.027)		(0.148)	
SOE transforming			-0.071*	-0.049		-0.058*		-0.028
			(0.037)	(0.038)		(0.035)		(0.116)
PSP in water supply			-0.118**	-0.106*		-0.108**		-0.093
			(0.051)	(0.056)		(0.053)		(0.384)
Individual and household characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Community characteristics	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Year dummy and province dummy	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Observation	912	768	912	768	768	768	719	719
R-squared	0.158	0.266	0.162	0.272	0.265	0.268		
Wald test (P-value)							0.657	0.333

Note: Each column presents the average marginal effect from separate regressions. Per capita household income inflated to 2015. Standard errors are in parentheses and in equation (1)-(6) standard errors clustered by community. The notion * is p<0.1, ** is p<0.05, and *** is p<0.01.

4. Conclusions

We found water reform, especially private sector participation leads to better health outcomes among children under years of five in rural area. The most possible reason might explain why PSP outperformed SOEs in reducing diarrhea is that water reform policy has given lower level autonomies authority and incentive to privatize their SOEs. Therefore, PSP in water supply more likely to be implemented in higher risk areas with low piped water access, which leads to a greater improvement effect than SOE transforming.