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Impact of access to water and sanitation services on educational attainment

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ABSTRACT

Children are prone to the contagion of waterborne diseases without adequate water and sanitation services. When not sick, children and their caregivers without proper access to such services have to allocate their leisure time in order to meet their water and sanitation needs. It is through these health and leisure time use changes that access to water and sanitation services impacts the educational attainment of children. This paper proposes a household utility maximization model in which access and sanitation services determine the child's health, which in turn affects the child's education and the household welfare. Comparative statics indicate that households consider the health gains to the market value of their leisure time, and the changes in the consumption of other goods. The model is applied to data from Brazil. In order to sort out the endogeneity between provision of water and sanitation services, and educational attainment, the paper uses an instrumental approach, based on the technical features of the water systems and an instrument that measures a proxy of water availability within the municipality territory. Estimates suggest that access to water and sanitation services has a positive and significant effect on schooling, when measured by the completed number of school years. These positive effects call for the expansion of the laggard sewerage systems in the country, both at home and at school.

1. Introduction

The UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water GLAAS [44] indicates that 2.5 billion people do not have access to improved sanitation and around 1 billion people are forced to practice open defecation in 90% of the rural areas. Moreover, access to safe drinking water is not a reality for 748 million people around the globe, and 1.8 billion people are at risk of using a water source that can be faecally contaminated. The World Health Organization estimates that every $1 invested in better access to water and sanitation can represent returns ranging from $4 to $12. In addition to the economic returns of these investments, the access to such services is essential for the realization of human rights for all [44–46]. These figures reveal the global impact of the problems associated with the access and the provision to water and sanitation services. They also highlight the relevance of studying how they can become an obstacle for development, and identify the possible policies to overcome them.

Inequality in access to water and sanitation may translate into inequalities in health and education. When not connected to water and sewerage system, household

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members, in particular children, can be more prone to the contagion of water-related and water-transmitted diseases that prevent them from attending school and from academically succeeding. Children may end up spending more time collecting, hauling, and taking care of water and sewerage storage than attending school or preparing homework. Without proper water and sanitation services, adequate hygiene is not maintained, which, in turn, increases the likelihood of contracting diseases.

Academic performance in school depends on access to water and sanitation services in two different ways. First, water-related diseases are transmitted through five main routes: waterborne diseases (like cholera and typhoid), water-washed diseases (for instance, trachoma), water-based diseases (such as schistosomiasis), water-related and vector-borne diseases (such as malaria, filariasis, and dengue), and water-dispersed infections (such as legionellosis) [25]. Thus, better water and sanitation services help households save on healthcare and improve productivity. Second, studies have found that dehydration may harm cognitive discrimination and short-term memory [30]. As a consequence, lack of water impairs children's academic performance by reducing their cognitive capacity.

The goal of this paper is to explore how access to water and sanitation services affects school attainment, measured by the completed school years[2]. The theoretical model that will be developed in the paper is applied to data from Brazil, a country marred by inequalities [24]. In terms of water, the economically prosperous southeastern and southern regions fare better in the provision of access to water and sanitation services than the poorer regions of the country. For Brazil, the study of access to water and sanitation services is relevant, mainly because of the inequalities across the country. The poor semi-arid regions may be condemned to a vicious cycle of poverty, because water scarcity translates into reduced schooling and lower human capital accumulation. Another reason is related to the institutional and technical conditions of the water and sanitation sector in the country. Water shortages and badly functioning water and sewerage systems can curtail the effectiveness of education and health spending of all levels of government. The final point of relevance arises from an international and sustainability perspective. Impacts from global warming on water availability will force policymakers and users to consider better ways to deliver the services, and to make rational use in a fashion that is sustainable and that may not pose risks to human health.

As its first contribution, this paper explores how non-access to natural resources becomes a barrier to social policy in a developing country. In the case of Brazil, it is possible that conditional-cash transfer programs can actually have a bigger impact in breaking the path of poverty if water and sanitation are also available for households. Expanded coverage of services will result in healthier households and more time available to achieve higher levels of education. Tackling endogeneity and simultaneity in the study of access to water and educational achievement is the second contribution. It is important to solve the endogeneity problem because, otherwise, all estimates can be biased and lead to the wrong policy implications. The final contribution of the paper is it offering of a theoretical household utility maximization model relating access to water and sanitation services to health and education.

Results indicate that there is a positive effect of access to water and sanitation services on the number of completed school years using data from the 2010 Census sample. The impact of the access to sanitation services (measured through having a connection to the sewerage system) seems to be larger than the connection to a piped water source. By using different samples defined by the age of children, it seems that the effect builds up over time: the longer the children are exposed to the connection to sewerage and water systems, the wider the difference in school years compared to those that do not enjoy such amenities. This time-related trajectory points at the accumulated effect of health on education. The use of a set of instrumental variables related to water availability and technical specifications of the water systems reveals the real extent of the endogeneity bias.

2. Literature review[3]

2.1. The benefits of access to water and sanitation services

Access to water and sanitation services was defined as a human right by the [46] (Resolution 64/292; [44,45] the United Nations General Assembly). The human rights perspective obliges governments to act in a positive and proactive way, for instance, by expanding coverage [3]. The global economic return on sanitation services is found to be US$ 5.5 per US dollar invested, while the return on water supply is US$ 2.0 per US dollar invested [26]. The time available for livelihood activities increases as the incidence of diarrhea falls [10].

There are three main challenges in improving the access and quality of water and sanitation services: first, the significant investments in operation and maintenance; second, lack of governance policies promoting private sector involvement; and, third, difficulties in setting appropriate pricing structures [39,9]. Construction of water and sanitation systems is followed by water connection decisions made by families. Subsidies have tended to target consumption and not the connection costs [4]. Access to credit, and not the costs, is the real obstacle to improve households' access to higher-quality water [16,17].

[2] The Brazilian Sanitation Act (Federal Law 11.445/2007) states that sanitation services are composed of water, sewerage treatment, and garbage collection. Garbage collection is also very important for the health and welfare of children. The exposure to garbage may lead to infectious diseases too. Here, garbage collection is not addressed, because there seems to be no ideal instrumental variable to sort out the endogeneity problem that such a service might have with education.

[3] For a full discussion of the literature review, theoretical model and empirical strategy, the reader is advised to review the Working Paper version available at: http://goo.gl/Onvykq