Cost-effective provision of safe drinking water to households in rural Bangladesh

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- This brief explores how to price household water connections to a rural pipeline scheme to optimise cost-effectiveness.
- If the goal is to maximise revenue collection, charging households BDT 1200 is the best strategy. However, many households will not adopt the connection at this price.
- If the goal is to spend government funds most efficiently at the lowest price per connected household, then the best strategy is to provide connections for free due to the efficiency of constructing pipelines that serve many households in a small area. This effect dominates any revenue raised by charging prices to connect households.

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Policy motivation

This brief focuses on Bangladesh's safe drinking water crisis. Despite decades of effort, 59% of its population still lacks access to safely managed water, as defined by Sustainable Development Goal (SDG) 6, a statistic that has improved by just 4% since 2000.

Previous efforts have primarily focused on improving access to safe drinking water by building safe community tubewells, but community wells alone will not solve the problem. Many households will not walk far to collect water, so they continue to use other unsafe sources. Collecting water outside the home increases the risk of re-contamination during transport and storage. Wells that are used by many households can also become contaminated.

A potential solution is to expand access to piped drinking water connections in rural Bangladesh. Piped water connections may be an effective way to ensure universal access to safe drinking water. Piping water into the home reduces the risk of contamination via transport and storage. It reduces the possibility of cross-contamination between users, as only one household uses each access point.

However, piped water networks are expensive, and the fiscal space is narrowing. A key policy unknown is whether and how much to charge households to connect to a pipeline network. Charging households a higher price increases revenue per connected household, which can then be used to offset costs. However, the higher the price, the fewer households will connect. Pipeline networks that serve many households close to one another have lower costs per connected household than networks that serve fewer households or households farther apart.

This study builds a pipeline network and measures demand for a household connection. The results allow for modelling the consequences of different pricing strategies.

Overview of the research

Measuring demand is tricky. Simply asking people how much they are willing to pay for access to safe drinking water may not be reliable. People may report a lower amount than is accurate if they think the price they will be charged depends on their answer. They may report a higher amount than is accurate if they believe a project's funding depends on their answer. This research design sets out to measure demand accurately.

The study surveys all households in two communities in rural Bangladesh, asking them how much they would be willing to pay for a connection to a

pipeline network. Each pipeline network also has community access points that all households can use without paying anything. After respondents answer, they open an envelope containing a randomly assigned price voucher. If the value they reported is above the price on the voucher, they can keep the voucher and redeem it later if a pipeline is built in their community. If not, they do not get to keep the voucher. This design incentivises people to tell the truth about what they would be willing to pay.

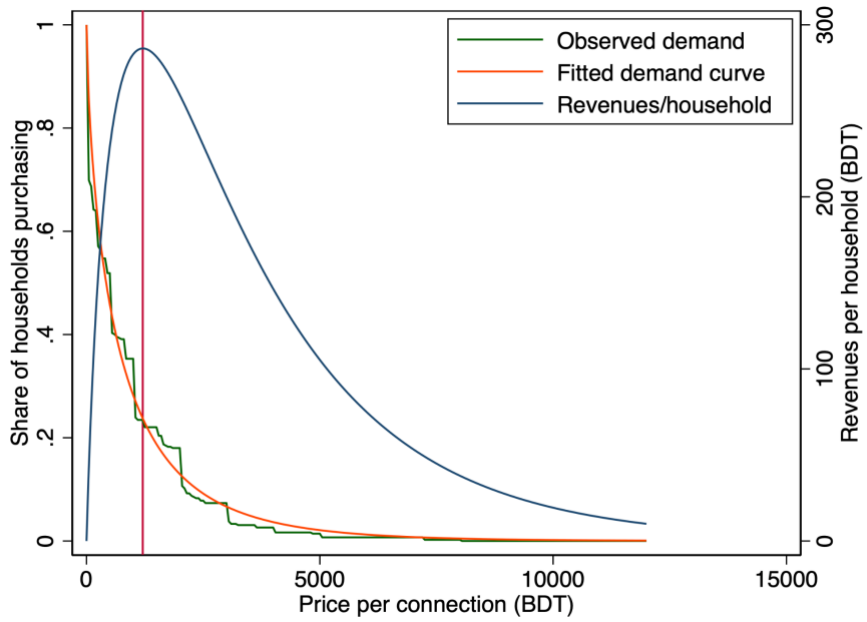
We then build a pipeline in one of the two surveyed communities (chosen at random) and keep track of the costs of building that pipeline.

Bringing all these components together, we can simulate what would happen to cost-effectiveness with different price policies.

Research findings

Most households will connect to piped water if connecting is free, but demand falls rapidly with price. At BDT 100, only three-quarters of households will connect; at BDT 1000, only a third will connect.

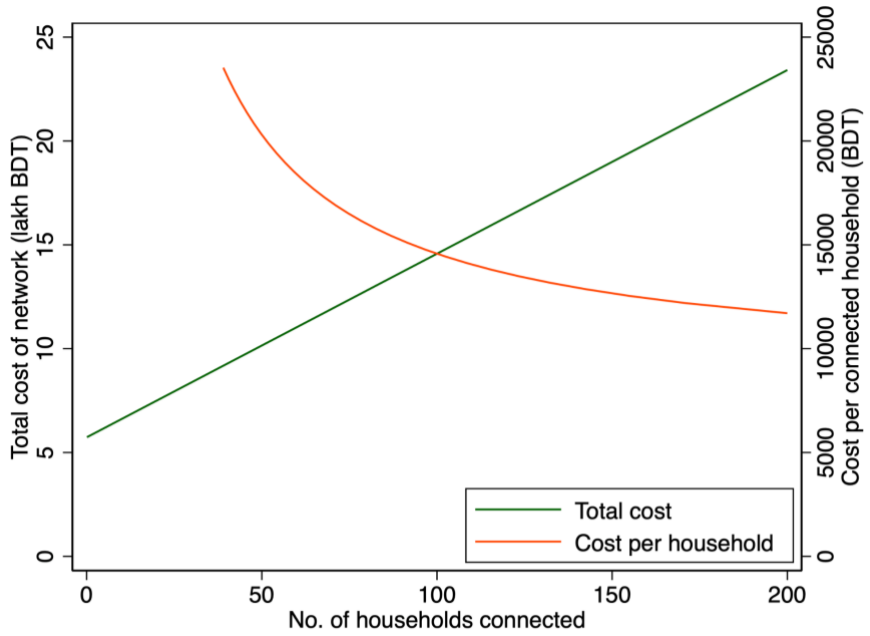
FIGURE 1: Demand and average revenue



Pricing has an efficiency-equity trade-off when it comes to raising revenues. The higher the price, the more each connecting household contributes in revenues and the lower the number of households that connect. If a policymaker wants to maximise revenues, they should charge a price of about BDT 1200. However, at this price, only about a quarter of households will connect.

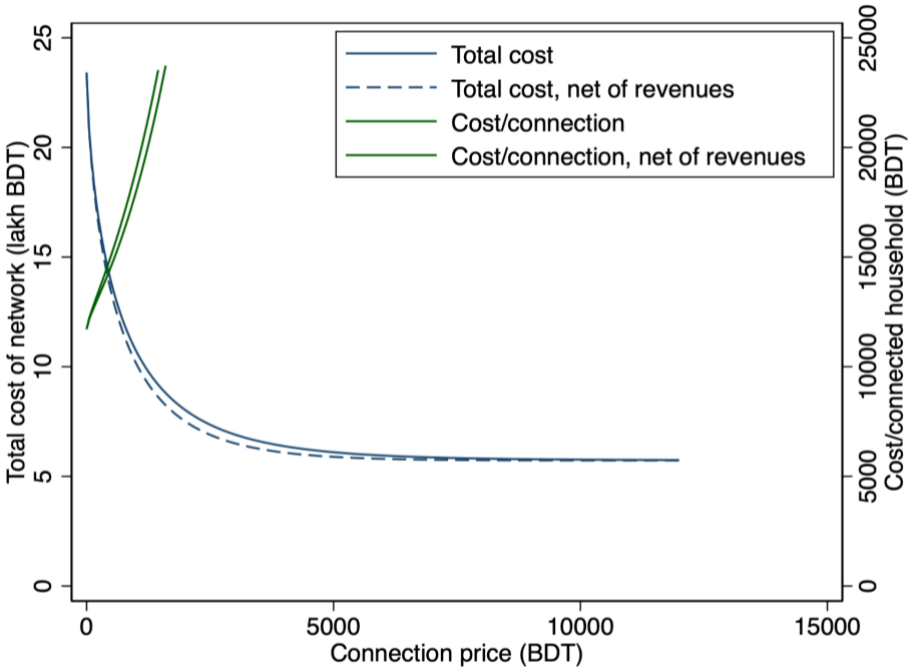
There are strong economies of scale. Pipeline networks have fixed costs that do not depend on how many households connect and variable costs that scale with the number of connections. The fixed costs are for a borehole, a pump, and an overhead storage tank. The variable costs are the pipes and taps for the household connections. The total cost of the network rises with the number of connected households, but the cost per household falls because the fixed costs can be shared across a greater number of households.

FIGURE 2: Costs of pipeline



Economies of scale eliminate the efficiency-equity trade-off. The price that minimises the cost per connection is *zero*. Any revenues raised is small compared to the economies of scale, as shown by comparing the dashed lines to the solid lines in Figure 3 below. There is no efficiency-equity trade-off: setting the price to zero maximises both access and cost-efficiency.

FIGURE 3: Costs as a function of connection price



Policy implications

- When setting prices for infrastructure, we need to think beyond which prices will maximise revenues. If economies of scale are important, the right price might be zero.
- A price of zero doesn't necessarily mean that no revenues are raised. An alternative might be to offer a basic service level for free with optional, paid-for upgrades. For example, a basic tap could be provided free of charge, with a menu of paid-for upgrades, including sinks or tiled housings. Revenues generated by the upgrades could help offset the cost of the system.