

Evaluating the Performance of Alternative Municipal Water Tariff Designs:

Quantifying the Tradeoffs between Equity, Economic Efficiency, and Cost Recovery

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The complexity of water tariff design

A unique tariff to achieve multiple criteria:

- ✓ **Financial self-sufficiency** (cost recovery)
- ✓ **Equity among customers** (low-income households should not be charged at a higher price than high-income households)
- ✓ **Economic efficiency** (price should reflect cost)

Which tariff?

Here we discuss trade-offs in terms of the three objectives between:

- ✓ **A uniform volumetric tariff** (unique price which is set equal to average cost)
- ✓ **An Increasing Block Tariff** (quite popular tariff structure with block-specific prices)

Why are IBTs so popular?

Because most people think they are fair in the sense that large users (by paying a high price) cross-subsidize low users (who pay a low price)

But cross-subsidization and fairness will be achieved under the following two conditions:

- ✓ The price in the higher block is higher than the average cost of water supply (to compensate for the price in the lower block which is subsidized)
- ✓ High-income users are large users and their consumption falls in the higher block while low-income users' consumption falls in the lower block (equivalent to say that there is a strong and positive correlation between income and water use)

But ... the latter is almost never observed in reality

Rich households are usually not large users...

Correlation between income and water use is very small, and almost null in four countries

<i>From household data (source: OECD survey)</i>	Sample size	Correlation coefficient
Australia	154	0.12 (n.s.)
Canada	47	0.27
France	326	0.15
Italy	249	-0.05 (n.s.)
Korea	109	-0.10 (n.s.)
Netherlands	191	0.12
Norway	57	0.32
Portugal	1575	0.18
Sweden	88	0.05 (n.s.)

n.s. indicates that the correlation is not statistically different from 0

Our simulation design and assumptions

- Hypothetical population of 5000 connected households
- Income and water use for each household are drawn from distributions calibrated from real data and assuming a level of correlation of +0.1 (in line with observational survey data)
- Price elasticity of demand is -0.2 and income elasticity of demand is 0
- Average cost of water services: US\$ 5 per m³
- Utilities operate at constant returns to scale, hence average cost = marginal cost

Our simulation scenario

- **Benchmark situation:** uniform volumetric price where the price is set equal to the average cost. Guarantees financial sufficiency and economic efficiency. Every household pays the efficient price so there is no subsidy being distributed.
- We measure the effect of moving to an IBT with two blocks.
- We set prices in the two blocks so that revenue = cost (financial self-sufficiency objective is achieved). **Hence price in the low block is below average cost while price in the high block is above average cost.**
- Under the IBT economic efficiency is no longer achieved since price is different from cost so households will suffer a welfare loss.
- Households in the low block receive a subsidy while those in the high block pay more than the marginal cost. **Equity impact: who gets the subsidy?**

Results from main simulation scenario

Scenario: From Uniform Tariff to an IBT with two blocks (first block: 10 m³ per mo)

100% cost recovery: financial self-sufficiency is achieved

Price in price in low block: US\$ 3.2 per m³ and price in high block: US\$ 6.4 per m³

Correlation between water use and income = 0.1

	Quintile 1	...	Quintile 5	Total
In total				
Total number of households	1000	...	1000	5000
Cost recovery (%)	97	...	103	100
Number of hh receiving subsidies	770	...	673	3614
Number of hh making payments	230	...	327	1386

Quintile 1: lowest income group (20% of the households)

Quintile 5: highest income group (20% of the households)

Results from main scenario (cont'd)

	Quintile 1	...	Quintile 5
For households receiving subsidies (price is below cost)			
Number of hh receiving subsidies	770	...	673
Total subsidies distributed (%)	21	...	18
Average subsidy per household (US\$)	11.4	...	11.2
Average water bill per household (US\$)	43	...	49
For households making payments (price is above cost)			
Number of hh making payments	230	...	327
Total payments made (%)	15	...	26
Average payment per household (US\$)	26.6	...	32.3
Average water bill per household (US\$)	241	...	267

Equity objective: 18% of the subsidies go to the richest group (Q5) and the lowest income group (Q1) only receives 21% of the subsidies

Economic efficiency objective: not shown here since welfare losses are very small

Distribution of subsidies across income quintiles: Role of correlations between water use and income

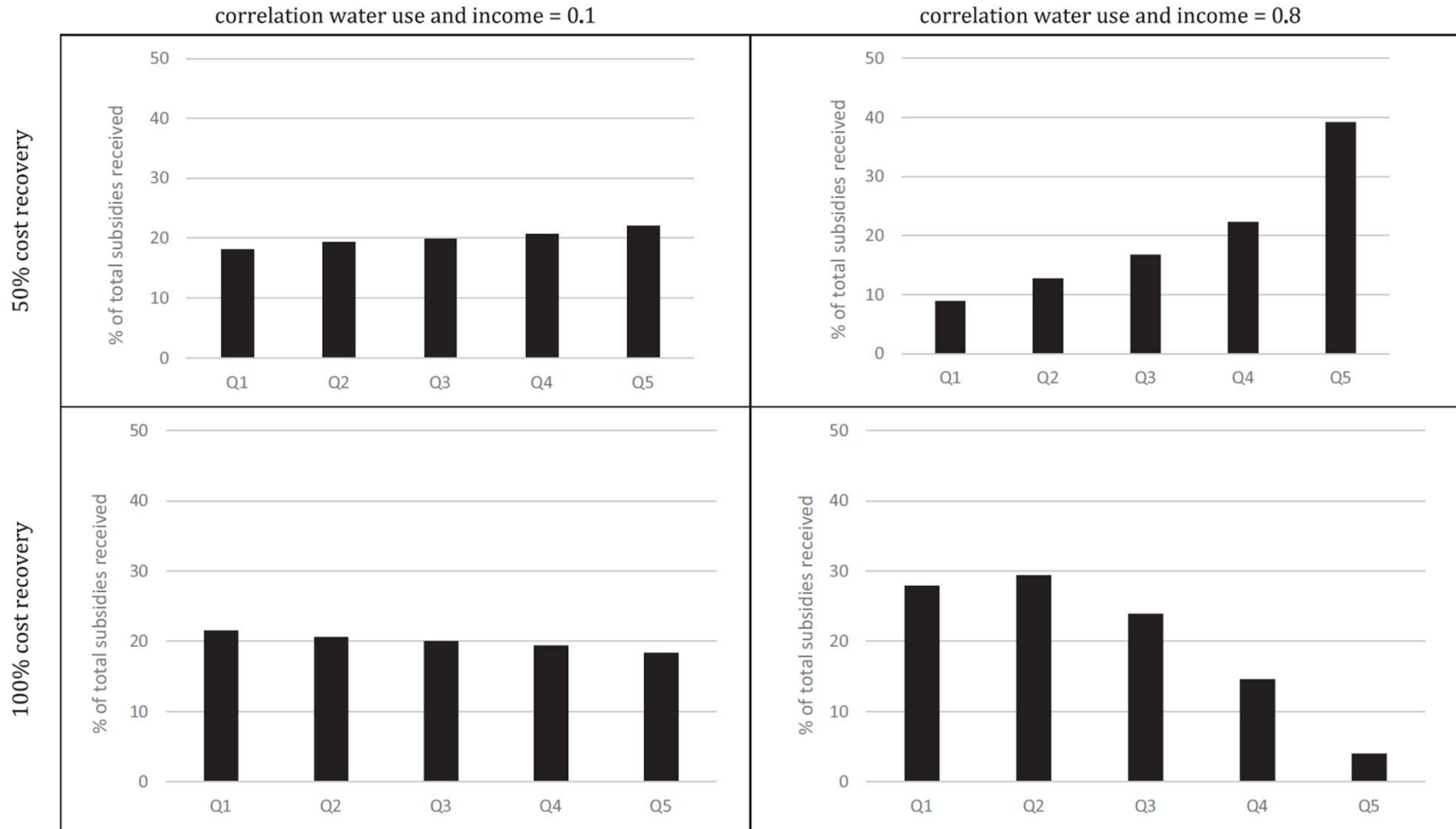


Figure 3. Distribution of subsidies across quintiles (Q1 to Q5) under four different scenarios (IBT with US\$0 fixed charge and 10 m³ lifeline block).

Summary: main points

- Increasing Block Tariffs (IBTs) are popular because most people think they are fair.
- Most people believe that IBTs are fair because large users (by paying a high price) cross-subsidize low users (who pay a low price).
- However in reality there are many rich households that use small amounts of water, and many poor households that use large quantities of water.
- As a consequence IBTs can perform badly in terms of equity and make rich people benefit from subsidized water price and poor people pay more than the average cost.

Summary: main points (cont'd)

- Only in situations where the correlation between income and water use is high will poor households get more subsidies than rich households (in proportion) ... but this situation is extremely rare.
- Affordability issues could be better addressed by means-testing instead of a block-structure, which would improve subsidy targeting.
- Increasing Block Tariffs (IBTs) do not achieve economic efficiency while uniform tariffs do if the price is set at the average cost.
- Uniform volumetric tariffs are simple and easy to understand.