Nguyen Bich-Ngoc[a], Jacques Teller[a]
Jean-Michel Compère[b], Alain Palmans[b]

[a] LEMA, ULiège, bichngoc.nguyen@uliege.be
[b] CILE, jean-michel.compere@cile.be

Social equity in water tariff design

INTRODUCTION

Water tariff need to balance among several objectives: (1) sufficient and stable revenue for water providers, (2) equity and affordability for customers, (3) economic efficiency and conservation for society. Increasing block tariff (IBT) is often believed to increasing social equity and conservation due to higher price for higher amount of consumed water [1]. Yet it was also criticized for its complexity and ineffectiveness in practice [2]. While assuming total cost recovery, social equities of several hypothesized tariffs were compared using empirical data from Wallonia (Belgium).

Methods

Data: survey data of 1500 households collected in 2014 containing:

- Annual water consumption
- Household characteristics: household size, income, rainwater use
- Geographical location

Tariff scenarios: three aspects of tariff were evaluated

- Fixed subscription fee
- Tax on having rainwater tank
- Uniform volumetric price (UP) vs increasing block tariff (IBT-con) vs increasing block tariff considering household size (IBT-cap)

Constraints: keeping the current revenue for water companies

Equity measurements:

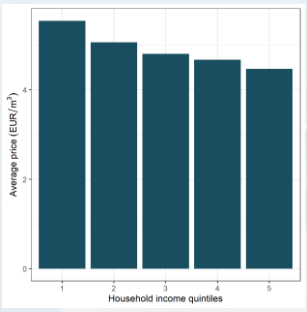
- Average unit price = Total bill/total water consumption (EUR/m^3)
- Subsidy
  = Total water consumption × average production cost – total bill [2]

Study region

Water tariff in Wallonia follow the European principles of full-cost recovery. It contains an annual fixed subscription fee (~100 EUR/household/year) and a volumetric part with 3 blocks. (Table on the right)

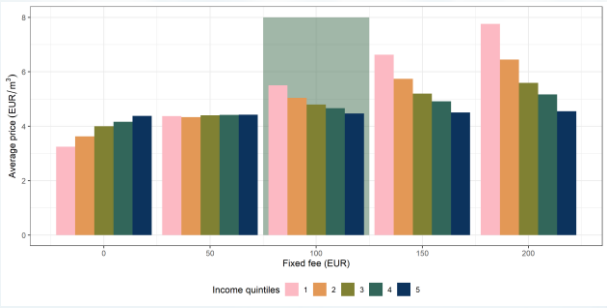
Tariff parts	Formula
Fixed subscription fee	20*CVD + 30*CVA (per household)
Volumetric charge	
From 0 to 30 m^3	0.5*CVD (per m^3)
From 30 to 500 m^3	CVD + CVA (per m^3)
Above 500 m^3	0.9*CVD + CVA (per m^3)
Social Water Fund contribution	0.0125 € (per m^3)
Value-added tax	6 % of the total bill

CVD: production cost (EUR/m^3)
CVA: sanitation cost (EUR/m^3)

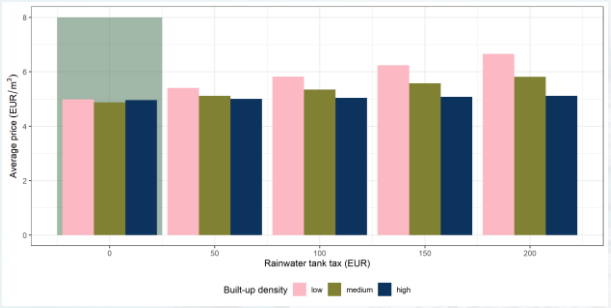


Residential consumption is often less than 300 m^3/year so it is only affected by the first two blocks with increasing prices. Water consumption was positively correlated with household income in the data. Thus, due to the large share of the fixed fee (~ 33% total bill), poor households often face higher average water price. (Figure on the left)

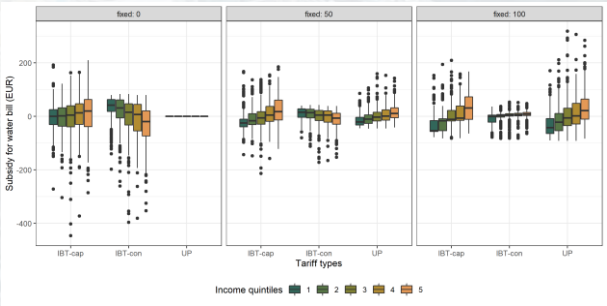
Results & Discussions



Changing fixed fee from EUR 0 to EUR 200 affects households in the first quintile of income the most. Since consumptions of households in the last quintile is higher, this fixed fee was diluted. (Figure above)



If a tax is imposed on families with rainwater tank, the families in low density areas would be affected the most. (Figure above)



When there is a fixed fee, both UP and IBT-cap show that higher income families receive subsidy from lower income families which is the opposite of the purpose behind these tariff designs. On the other hand, IBT-con show better social equity when there is a small or no fixed fee.

CONCLUSIONS

- High share of fixed fee in water bill led to higher average water price for low-income families.
- IBT-con with a small or no fixed fee support social equity with higher income family subsidize a part of water bill for lower income families.
- All analyses were done with an assumption of no changes in utilities revenue. However, an increase in company revenue is needed in the future to keep up with operation and invest in solutions to cope with climate changes.

REFERENCES

[1] Hoque, S.F., Wichelns, D., 2013. State-of-the-art review: Designing urban water tariffs to recover costs and promote wise use. Int. J. Water Resour. Dev. 29, 472–491.
[2] Nauges, C., Whittington, D., 2017. Evaluating the performance of alternative municipal water tariff designs: Quantifying the tradeoffs between equity, economic efficiency, and cost recovery. World Dev. 91, 125–143.

ACKNOWLEDGEMENTS

SECOND INTERNATIONAL CONFERENCE ON WATER, MEGACITIES AND GLOBAL CHANGE