

Newts microsimulation model for an informative and co-creative public-decision making

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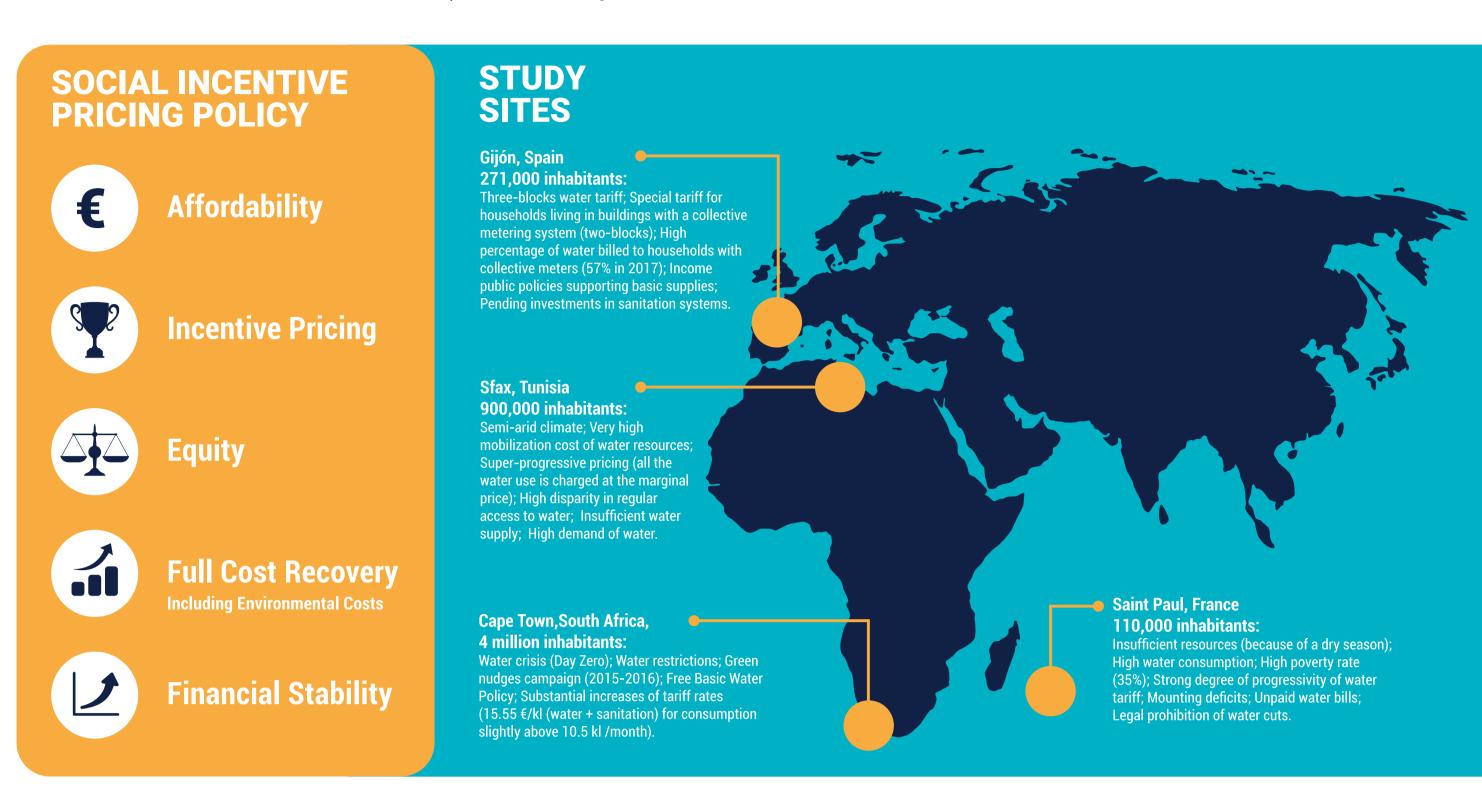
NEWTS MICROSIMULATION MODEL

FOR AN INFORMATIVE AND CO-CREATIVE PUBLIC DECISION MAKING

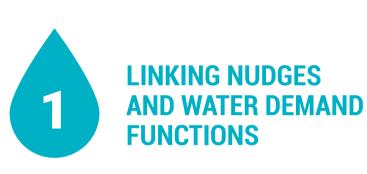
THE NEWTS PROJECT

water demand management. Prima facie, it aims to model, based on econometric estimates of household provide a socio-economic assessment of green nudging water demands, to assess the socio-economic returns of policies, focusing on water consumption controlling and mix policies, combining nudges and pricing instruments, proper understanding of the charging system by the and identify financially sustainable DSM (demand-side households, taking into account adjustments in the management) policies to improve current water utility pricing policy that nudges may generate (in view of their tariffs. effects on water demand functions). From an operational

The research program addresses the issue of household point of view, it consists in developing a micro-simulation



THE SCIENTIFIC PROJECT



Econometric estimate of local water demand functions

Nudges campaign / Randomized control trials / Impacts on water consumption (treatment effects)

Econometric estimation of resulting changes in local water demand functions

Identification of transmission channels: - decrease in captive consumption? - greater price-sensitivity? - improved perceptions of tariffs?



DSM POLICY

Socio-economic evaluation of local current water tariffs (through a dashboard of appropriate indicators, in each area of the EDF for water, making use of the information provided by econometric estimates of water demand functions)

Assessment of the contributions of nudges to the socio-economic performance of local current water tariffs.

Simulations of mixed programs, combining nudges and tariff instruments, making use of estimated econometric models and relied data sets.



ADVANCING RESEARCH IN BIS

Lab experiments to deal with time dimension and spillover effects (social interactions)

Improving the information conveyed by benchmarking and social normal information treatments (large consumer vs. over-consumer)

The use of smart technologies (nudges design, static vs. dynamic infographics, dark patterns)

Nudges perception (additional feedbacks from the field with local public consultation, local stakeholder consultation and focus groups)

GENERAL ARCHITECTURE

heavily on their intuition to assess how changes in water the behavior of systems of nonlinear equations." tariff regimes affect financial self-sufficiency, equity, and economic efficiency. Quantitative assessment of these Nauges C. & Whittington D. [2017], Evaluating the impacts requires the specification of a set of nonlinear Performance of Alternative Municipal Water Tariff Designs: relationships with numerous parameters, and then formal Quantifying the Tradeoffs between Equity, Economic simulation procedures to analyze how changes in the Efficiency, and Cost Recovery, World Development, tariff structure and price levels affect outcomes of policy 91, pp. 125-143

"Policy makers and water professionals often rely too interest. Intuition is an unreliable guide for understanding



POPULATION MODULE

describes the population of households with regard to some relevant variables for calculation and decomposition of (i) consumption, (ii) bills and (iii) indicators making up the dashboard.



describes the tariff system (based on French regulation) that applies for the households listed in the Population Module.

• In the case of IBTs: fixed part, number and size of consumption blocks, unit prices within each block, VAT rate and environmental charges for water service and wastewater service.

• The user is also asked to provide information on service costs (fixed charges, number of subscribers, unit variable cost of production for, successively, water and sanitation) and environmental costs (if available).



DEMAND MODULE

makes use of the econometric model to calculate for each household in the Population module:

• its water consumption $q_i = q_i^d$ (•)

• the related captive part and the size of its basic consumption like: $\ln \underline{q_i} = -2.56 + 0.48 \cdot \ln N_i + 0.44 \cdot SNWA_i$ (for instance; captive part is reprocessed by the user).



INVOICE MODULE

• computes the water bills with $T_i = T(q_i)$

• breaks down the water bill into a minimum basic type part (for water) $T_i^{min} = T(\underline{q}_i)$

and a non-basic type part T_i - T_i^{min}

 reconstructs the amount of invoice by distinguishing different subsidies and contributions to service funding (with reference to a structurally balanced two-part tariff $(F,\pi) = (\frac{CF}{n}, c)$



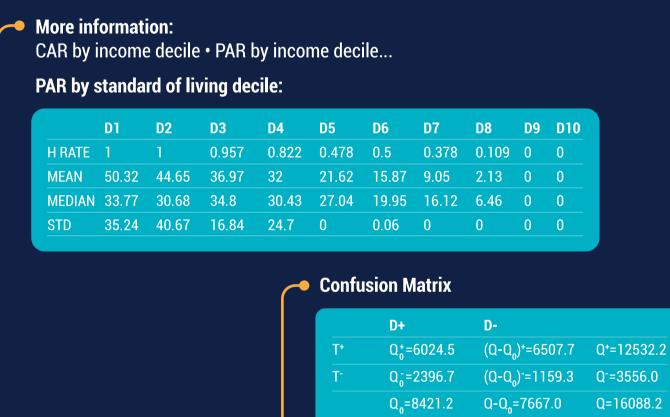
EVALUATION MODULE

includes a scoreboard and about fifty indicators (for level 1 information) allowing to measure the socio-economic performance of the pricing policy in the 5 fields of analysis set by E-WFD. These indicators correspond:

to those commonly used in academic literature on water;

• to other measures commonly used in other fields of Economics (Poverty Economics, Production Economics, Tax Economics, Banking and Finance ...) that are thought to be relevant for the field of analysis considered.

EVALUATION MODULE NEWTS DASHBOARD

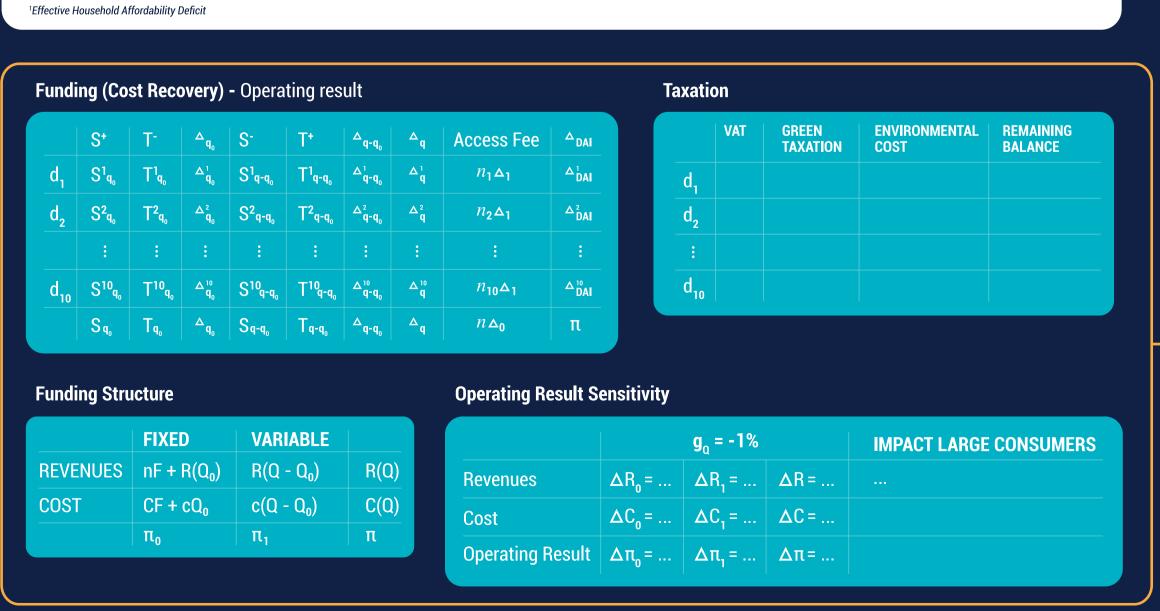


More information: Lambert & Aronson sub-group decomposition GINI INDEX | WITHIN | BETWEEN | TRANSVARIATION

| | | | • | | | | | |
|----------------|---------|---------|---------------------------------|---------------------------------------|------------------------|--------------------------|--|---------|
| AFFORDABILITY | | | INCENTIVE EFFECT | | ECONOMIC EFFICIENCY | | EQUITY | FUNDING |
| | CAR | PAR | Consumptions | | Service level | | Gini Index | |
| Mean | 2.7 (%) | 1.2 (%) | IBT | 45.12 | First best | Q* | Household income | |
| AV TBSE | + 1.3 | + 0.6 | TBSE | 34.98 | IBT | Q | IBT | |
| Median | 2.7 (%) | 1.2 (%) | PP IBT: | 38.00 | PP IBTI | Q _{K=1} | TBSE | |
| Std dev | 3.4 | 4.1 | Effective overconsumptions | | Full TBSE | Q _{Full TBSE} | IBTQ_TBSE | |
| Incidence | | | Household | 14.2 | Actual TBSE | Q _{TBSE} | SFB IBT | |
| | CAR | PAR | Per capita | 2.7 | | | | |
| Household | 0.628 | 0.424 | Std dev IBT | 11.87 | Gap (en %) | | RS Index | |
| Individual | 0.649 | 0.556 | Std dev PP IBT | 8.4 | | | Pfähler Index | |
| Child | 0.884 | 0.507 | Std dev TBSE | 12.57 | | | | |
| Intensity EHAD | | | | | Change in Agg. Surplus | | Per capita income | |
| | | TBSE | | | IBT | ΔΓ= | | |
| Mean | 40.58 | + 7.2 | Invoices (euros per trim.) | | PP IBT | ΔΓ _{K=1} | Concentration coefficients for H income with respect to living standard: | |
| Median | 33.78 | + 3.4 | IBT | 167.33 | Full TBSE | ΔΓ _{Full TBSE} | | |
| Std dev AD | 29.78 | -8.07 | PP IBT | 129.12 | Actual TBSE | ΔΓΙ _{τΒSE} | Relative net benefit distribution curve and Quasi-Gini Coefficients | |
| Inequality | | | TBSE | 141.04 Change in co surplus (first | | mer (household) k) | | |
| Gini Index | 0.410 | 0.405 | | | IBT | ΔU= | | |
| Schutz Index | 0.217 | 0.220 | Mismanagement costs (effective) | | PP IBT | ∆U _{K=1} = | | |
| Decile ratio | 6.1 | 4.7 | Household | 14.25 | | | | |
| Decime ratio | 8.2 | 5.9 | Per capita | 4.01 | | | | |

TPR: 71.5% • Miss Rate: 28.5% • TNR: 15.1% ... DOR: 0.448

Kappa score: -0.137 · Cohen Ratio: -0.288

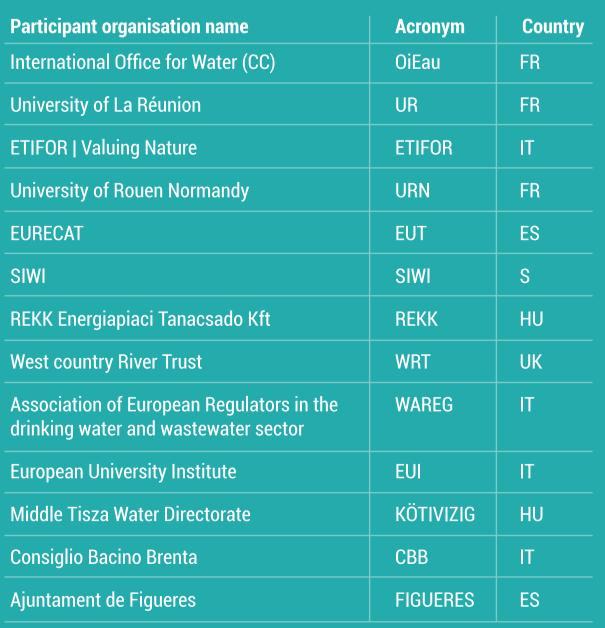


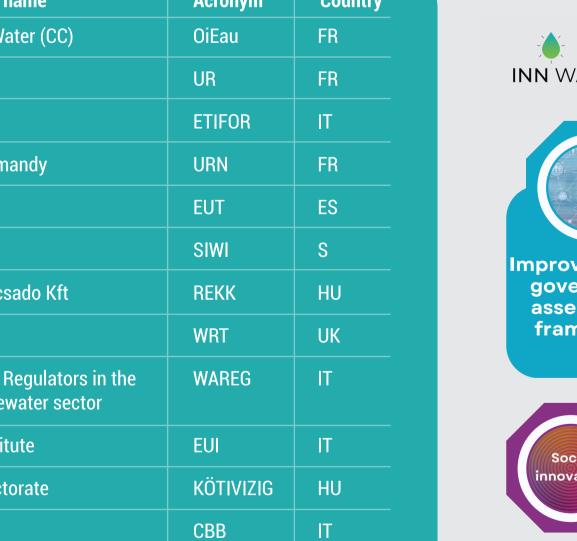
FUTURE DEVELOPMENTS

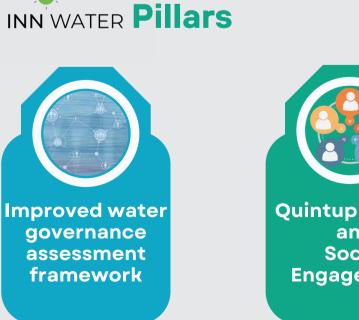
Specific improvements with:

 Consideration of the amenities (for the measure of the environmental cost);

- Additional indicators related to Political Economics (polarization index) and social part of the water pricing policy;
- Assistance program module for means-tested measures (e.g. aid for unpaid bills, water vouchers, water cheque rebate);
- Decision support Module with reinforcement learning algorithms (artificial intelligence);
- Efficient digital environment (dashboard design, data visualization, information depth, usability engineering ...)
- Up-scaling at the basin level (for integrated management of water resources) with the setting of an aggregated dashboard, mapping of the socio-economic performance of decentralized water DSM policies and spatial inequalities, and integration into a CGE Model (and WEFE nexus)







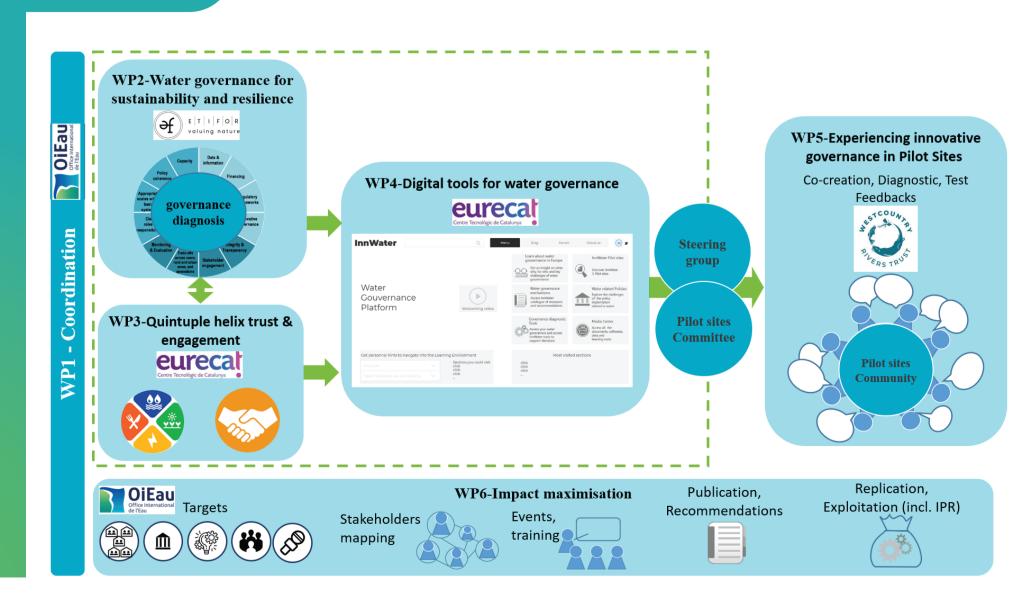






supporting InnWater cross-sector and multi level governance platform for improving water governance and policy recommendations





















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