ECONOMICS AND FINANCING IN THE WATER SECTOR

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Summary

Literature and practice emphasize the need for water prices to be based on both "economic and environmental efficiency" and "broad (social) equity" goals and stress the desirability of consumption-based pricing that improve pricing signals in order to move towards sustainable use of the natural resource.

Growing demand of natural resources by a growing world population induces indeed to predict that, without government intervention, mismanagement and scarcity will prevail because externalities are present and natural resources are very often public and/or common goods. Even if new discoveries and technical progress exist and delay the imminence of non-renewable resource exhaustion the question is whether, and for how long, such mitigating factors will continue to produce their positive effects in the future.

So getting the "value" of water rights and use accepted methods to evaluate quality of water, user costs, and external effects is then currently challenging Economists.

Approaching the economic evaluation of practicable future strategies that may allow for speeding water business change and thus deciding now what to be tomorrow is, on the other side, the challenge for water utilities Top Management.

The more the management is able to merge into an economically balanced context the customer needs satisfaction, on the one hand, and the resources' expected reward, on the other hand, the more the business will be competitive. Top Management is therefore strongly required to define and adopt strategies that suitably comply the economic expectations by shareholders or, in other terms, able to "create economic value" for them while improving business performance and increasing the level of provided service.

Peer comparisons and suitable reactions suggested by Benchmarking practices strongly

help best competitors to be ahead of changes provided by proprietary know-how and facilitate the Top Management mission.

UN’s Millennium Summit in 2000 and the Johannesburg World Summit on Sustainable Development in 2002 established internationally agreed targets for water supply and sanitation. On such a purpose the Millennium and Johannesburg Summits, and the publication of the “Camdessus Report”, have helped to raise the profile of the sector.

Some estimates suggest that achieving these targets will require enormous finance from all sources and fundamental reforms of water governance into a context where many Governments are finding the burden of public finance increasingly difficult to bear, particularly when developing countries are interested by.

Involving private capital, under various forms of service contracts and played roles, is then the real opportunity for Governments to carry out one or more specified tasks, or the service itself, for a stated period of time, to increase private investments in water and wastewater services, to expand their access to new financial resources, as well as to new technical and managerial skills.

1. Water Pricing

A *tariff* is the system of procedures and elements which determines a customer’s total water bill and result from a combination of a number of elements:

- a “one-off” and (normally) “up-front” *connection charge* rewarding the connection of customer premises to the public water supply and/or sewage systems and generally distinguished between non-recurring connection charges and recurring fixed charges;
- a *fixed charge* (or standing charge or flat fee) that can be equalized for each customer or linked to some other customer characteristics and covers the costs which are not directly linked to the consumed volumes (such as meter maintenance and reading, billing, and collection costs);
- a *volumetric rate*, to be applied to the volumes of water consumed in a charging period, that should ideally recover all costs which vary with average or peak demands placed on the system in both the short- and the long-run. When the volumetric rate is block structured, lower and upper volumes of consumption per charging level need to be defined and different volumetric rates are to be attached to. If rates rise or fall consistently as more water is consumed the schedules are referred to as increasing- or decreasing-block tariffs, respectively;
- a *minimum charge*, usually imposed to protect the utility’s finances, which specifies that a certain minimum volume of the service will be paid for in each period whether or not that amount has, in fact, been consumed.

Water demands are not evenly spread over time: both agricultural users and households tend to demand more water in hot and dry conditions and many other non-climatic factors and habits also drive peaks over shorter time periods (within-the-day and, to a limited degree, within-the-week).

In such temporal variations large costs have to be faced by water utilities, if supply systems are to be constructed, maintained, and operated at a scale which can satisfy whatever peak flows may ultimately be demanded, and pricing needs in principle to "compete" with storage as a way of reconciling supplies and demands.

Problems of establishing the most economically and environmentally efficient solutions (more storage, more demand management through extra tariff sophistication, or some combination of these approaches) thus couple the need of considering criteria of equity, technical feasibility, consumer understanding and acceptability before final decisions on tariff structures are made.

Effectively combining the above key issues is the real challenge for water charging policy makers indeed.

Most Countries have since time developed water pricing systems that better reflect the marginal costs of service provision, at the same time implementing a number of innovative policies that address social equity issues and encourage economic efficiency for a more sustainable use of water resources.

However, and even if some general trends can be identified, the specific paths taken by individual Countries towards these goals differ largely as a result of differences in their prevailing water supply situations and in their cultural and political contexts.

Moreover, given the widely differing demand patterns placed on water supply/disposal systems and the different cultural and institutional frameworks (where a general shift in the role of Governments, away from being the "provider" and towards being the "regulator", can be observed) within which water services pricing policies have to operate, it is not surprising that there continues to be considerable variation in world-wide pricing structures.

The range of household water charging structures in place in most Countries extends from increasing-block structures to various other forms of volumetric system, to predominantly flat-fee tariff structures, and even to the recovery of water service costs via the general taxation system.

Nevertheless some key issues have suggested remarkable changes in approaching charging policies and water rate structures during time.

The need to both better reflect marginal costs and deliver incentives for water conservation resulted in a general movement in many Countries away from decreasing-block and flat-fee pricing structures for the domestic sector, and towards either uniform volumetric or increasing block tariff systems. Most Countries also use two-part tariffs (i.e. with fixed and volumetric components), with the volumetric portion making up at least 75 per cent of the total water bill and the fixed portion used to best achieve particular policy objectives.

Policies aimed at improving the affordability of water services are also increasingly better targeted to the groups most in need that initially resulted in innovative tariff structures offering separate tariffs to specific low-income consumer groups or in applying across-the-board subsidies to water consumption, or large free initial water consumption allowances.

Funding possible solutions to make groups of households (or households in general) able to afford the water services provision may originate from government bodies (local, regional, and national), although the tariff-based approach is more likely in practice to be self-financed by the utility (i.e. through some form of cross-subsidization).

Such cross-subsidization can and does occur both from non-household sectors (e.g. industry and commerce) and also within the household sector (i.e. from rich to poor).

Nonetheless significant reductions in total subsidies, and in cross-subsidies between user groups, have been recorded where “full cost recovery” has been adopted as an operating principle in the management of public water supply systems. Even where subsidies still exist, there is much more emphasis on the need to make these subsidies transparent and to better target them to their intended purposes. On the other hand reducing subsidies to the users of water services not only enhances cost recovery objectives but also may lead to a higher quality and stability of service over the long-term.

When the real costs of water provision and waste disposal rise, metering of individual household water consumption allowing for volumetric charging, which reflects the costs of the water actually consumed by each household, may be desirable on equity and transparency grounds and even useful to achieve demand reduction targets.

This explains the continued increases in the penetration of water metering over the last decade, with regard to both single-family households and individual apartments, believed to be necessary because water charges, previously included with a number of other services into the monthly rent (or into the annual general costs), did not provide customers with a correct awareness of the value of received water services useful to orient consumption behavior to water saving targets.

Metering enhancement supported indeed the theory that increasing domestic water prices, coupled with moves towards volumetric or marginal cost pricing, do provide incentives for water conservation by households.

Water supply and waste disposal prices have generally increased over the last decade, and significantly so in a few Countries, particularly devoting increased attention to charging for wastewater disposal on the basis of the treatment costs actually faced by service providers and in some cases also shifting towards recovering wastewater charges through volumetric charging, and separately from water supply.

A wide range of practices concerning the application of water taxes and charges also influences Price levels. VAT is the most common tax applied, with rates sometimes exceeding 20 per cent, and abstraction charges are generally levied on households while pollution charges are in place in some cases.

Although the price elasticity estimates continue to show generally lower values, a number of uncertainties remain regarding the effects on household demand by changes in water pricing structures and levels because it is often only after a certain threshold change in price levels that consumption patterns respond elastically.

In addition, increasing prices (and increasing revenues) can sometimes be associated with better infrastructure or higher water/service quality that may actually lead to increased consumption, despite the higher price levels.

The above trends anyway reflect a growing tendency to generally moving away from the pricing of water services solely to generate revenues towards the use of water pricing practices to achieve a wider range of economic, environmental, and social objectives: the increasingly common use of volumetric pricing structures can improve economic efficiency through the better reflection of marginal costs in water prices and can also encourage water conservation through the levying of a positive cost on each unit of water used while enhancing equity goals through charging each consumer according to their actual consumption level.

Similarly, reducing subsidies and increasing water prices can lead to financial stability for the water services provider, as well as encouraging water conservation among consumers.

The use of increasing-block volumetric tariffs can also promote conservation objectives, while contributing to the affordability of basic water services for low-income households.

Although considerable information on water price levels and structures worldwide adopted can be collected, in many cases comparing data to establish clear trends or current practices within individual Countries, or across the water arena as a whole, is not always possible.

On such a purpose the IWA Specialist Group on Statistics and Economics is since time working out a significant attempt that aims at, periodically updating relevant series data across main Countries in the five Continents.

Every two years since 1992, a specific survey establishes, in a number of cities in each of the participating IWA members, the average water bill (quoted in US Dollars and including both drinkable water and wastewater treatment) referred to a consumption of 200 m^3.

The results of latest survey have been presented at World Water Congress held in Vienna on September 2008.

This “cost of 200 m^3 per year” series, which includes VAT and other consumption/sales taxes, is then related to an indicator of purchasing power in each country (GDP per capita) in order to generate a rough relation between the average water supply expenditures and the average ability to pay.

Adopting a uniform currency, normalizing the billed consumption and the customer patterns and referring to a uniform parameter to be assumed as a surrogate for “ability-to-pay” rank the IWA survey as one of the most relevant effort to update and compare water pricing levels and structures and to provide a rough indicator of relative average affordability across the world.

2. Impacts of Water Scarcity and Externalities Costs

When the optimal use of natural resources (NR) is concerned with, a distinction needs among renewable resources (to be optimally used) and exhaustible ones (to be optimally depleted).

Specific rules are well established in the economic literature for both types of NR, indeed.

Taking the rate of exploitation equal to the rate of reproduction and maximizing the present value of profit that is coming from it, is the rule to be applied to renewable resources.

While depleting the resource at a rate such that its price grows at the discount rate, is the rule to be applied to exhaustible resources (this last is known as the Hotelling rule).

Possible overexploitation of non-renewable resources received intermittent attention by the economists during time: lots of controversies rose about precise definitions, contents, ways of measuring and pursuing sustainable development, etc., but despite the multiplicity of voices it is possible to organize and simplify the debate around two different positions which correspond to an optimistic or to a pessimistic point of view.

For the first group, the scarcity of NR doesn't place any problem to the economic growth since"…*the market generates signals and incentives which ensure that discovery and substitution are carried out at an appropriate intensity*", or, in other terms, as far as substitution among capital resources (whether natural or human-made) is possible and as far as technical progress will continue to develop as it did in the past.

For the second group, without government intervention mismanagement and scarcity will prevail because externalities are present and NR are very often public and/or common goods. In other words, studies of this type underline the very fact that quite often the market signals and incentives are distorted while in several relevant cases they simply do not exist.

When investigating the efficiency of non renewable natural resources utilization Hotelling assumes a "finite" availability of them: quantities consumed today are no more available tomorrow, so here is an opportunity cost to be considered (the already known user cost or royalty or in situ value).

Several studies have been produced with the aim of empirically testing Hotelling rule implications that for the most part did not result consistent with empirical studies. The reason seems to relay on the existence of several "mitigating factors" (such as new discoveries and technical progress) that have delayed the imminence of non-renewable resource exhaustion.

The question is therefore whether, and for how long, such mitigating factors will continue to produce their positive effects in the future, notwithstanding the growing demand of NR by a growing world population.

The case of water is probably the most interesting and complicated in the field of NR studies given its importance and peculiarities.

Water may be indeed a renewable resource when it comes from surface, although at an unknown rate, but even a non-renewable one, when it comes from underground and is pumped up at a rate greater than its recharge rate.

By another point of view water is a NR that is fundamental to life, has no substitutes and its market ”signal”, i.e. its selling price, is in general distorted (in the sense that market does not capture either all the externalities produced by the water use or the “user cost” by present generations).

When an exhaustible resource is used its stock depletes, so the price for the actual consumer has therefore to include the compensation, which is in general not considered, for such a reduction.

Last but not least, the quality of both ground and surface water may be impaired by contamination from several sources and when such contamination is above certain levels water becomes unsuitable for plant, animal and human life so further reducing the available quantity of the resource.

The above-mentioned reasons make economists actively facing the problem of getting the ”value” of water rights and therefore of using accepted methods to evaluate quality of water, user cost, external effects, etc.

Castellucci, Drusiani et al. suggest a mathematical model analyzing the non-renewable resource depletion, where social benefits gained through the use of the natural resource are represented by a strictly concave function while extraction costs are assumed to be increasing and convex.

Authors focus on groundwater as a non renewable resource (being anyway possible to introduce a rate of recharge parameter) and assume that there are water leakages arising in the extraction and/or distribution processes that are defined as the percentage of water extracted that is lost during extraction and distribution and whose costs start in the first considered period (being the amount of consumed water affected by the quality of water infrastructures).

Suggested model also accounts for subsidence externalities related to the diversion of groundwater where an increase in the amount of water extracted in time 0 causes an increase in subsidence in period 1.

Similarly to the extraction costs, even the external costs related to subsidence are assumed in the model to be increasing and a convex function of the amount of water diverted during the first period.

Authors furthermore point out two different approaches to social welfare maximization distinguishing the focus on the present value of net benefit coming from long term water consumption from the "myopic" attention to the net benefit maximization at time 0 (that seems to be closer to the real life of many countries where groundwater is considered a common property resource whose entry is allowed simply through the payment of a "concession" fee).

The study explores the Italian situation aiming to demonstrate how such a myopic behavior can influence planning water extraction, social welfare and water tariffs so keeping planners far from the social optimum.

So doing, 1996 Italian data, in terms of shadow pricing and social welfare, have been collected allowing estimate the individual demand for water in the Country and the related extraction and external modeled costs and then calculate the amount of water to be extracted under the two above different approaches.

Comparisons result in an always-positive difference between water withdrawn in the myopic case and that under social welfare maximization as well as in strict relationship between the excess water extraction in the myopic case and the external costs.

The above demonstrates that the maximum level of social welfare is not consistent with the myopic approach, even if the model considers leakage reduction costs, and induces the conclusion that adopting myopic point of view can induce, on the one hand, distorted resources policies and, on the other hand, may require fine tuning water pricing so that water scarcity and external costs related to water extraction be accounted for.

In other terms this means to move from a water price that equals marginal extraction costs to a new tariff that even include the shadow cost of extracting water in the current period (where this last is given by the present value of the sum of the scarcity rent – that is the *marginal user cost* - added by the *marginal external costs*).

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Bibliography

Achttienribbe G., Homer V., Parena R. (1998). *Different approaches to charging water: the IWSA comparisons*. International Conference on European water policy, IX H2Obiettivo 2000, May 1998, Venezia, Italy. [This is a contribution presenting the statistics and connected methodologies worked out by the IWA Specialist Group on Statistics & Economics]

Alegre H., Hirner W., Baptista JM. Parena R. (2000). *Performance Indicators for water supply services*, IWA Manual of Best Practices, Iwa Publishing [This includes a comprehensive set of well devised

Performance Indicators useful for metric Benchmarking water supply services]

Cabrera E.jr. (1999). *Benchmarking de procesos mejora de la gestion de abastecimientos de agua potable*. Benchmarking course, Grupo Mecanica de fluidos, Departamento de Ingenieria Hidraulica y Medio Ambiente, University of Valencia, Valencia, Spain.[This is the proceedings of a course at the University of Valencia, Spain, exploring how Benchmarking exercises can improve the water service management]

Castellucci L., D'Amato A., Drusiani R.,Spaggiari G. (2005). *Water Tariff Policy when Scarcity, Externalities and Leakages are Considered*, IWA International Conference on Water Economics, Statistics and Finance, July 2005, Crete, Greece.[This is a contribution presenting how externalities and shadow costs may impact on water pricing policies]

Helland B., Adamsson J. (1999). *Performance benchmarking among 6 cities in Scandinavia*. Internal report, Oslo, Norway.[This is a report analyzing the results of a "6 Cities Group" Benchmarking project, run in Scandinavia]

Huberts J., Smeets E. (1999). *Performance indicators and benchmarking evaluation of company efficiency: the system employed by WML in The Netherlands*, 22nd IWSA World Water Congress, Special Subject 14, September 1999, Buenos Aires, Argentina.[This is a contribution presenting the methodologies adopted by the water company of Maastricht, in The Netherlands, to evaluate the internal efficiency]

IWA Specialist Group on Statistics and Economics. (2004). *International Statistics for Water Services.* 3rd IWA World Water Congress, September 2004, Marrakech, Morocco and IWA web site.[This is the leaflet on "International Statistics in the Water Sector" that the IWA Specialist Group on Statistics & Economics worked out and presented at the Marrakech World Water Congress in 2004]

Matos R., Ashley R., Cardoso A., Molinari A., Schulz A., Duarte P. (2003). *Performance Indicators for wastewater services*, IWA Manual of Best Practices, Iwa Publishing [This includes a comprehensive set of well devised Performance Indicators useful for metric Benchmarking wastewater services]

OECD, Environment Directorate (2000). *Global Trends in Urban Water Supply and Wastewater Financing and Management: changing roles for the public and private sectors.* [This presents a comprehensive discussion of public and private co-operation]

OECD, Environment Directorate, Environment Policy Committee (1999). *Household water pricing in OECD Countries.* [This presents a comprehensive panorama on water pricing policies in OECD Countries]

OFWAT (1999). *Comparing the performance of England & Wales water & sewerage companies with Sydney Water and Water Corporation Western Australia*. Report August 1999, OFWAT, Birmingham, UK. [This is the report by the UK National Water Regulator (OFWAT) to analyze the results from a Benchmarking project between UK and Australian water companies]

Paralez L. (1999). *Utility benchmarking on the West Coast*. AWWA Journal, 91 (11), pp. 65 – 71.[This is an article describing the methodologies adopted in USA to develop a Benchmarking project between west coast utilities]

Parena R. (1999). *The IWSA benchmarking initiatives, Performance Indicators for water and sewage services: an actual tool for better management and public regulation*, Hydrocontrol International workshop, May 1999, Cagliari, Italy.[This is a contribution presenting how performance evaluation can positively impact on both utilities management and public water regulation]

Parena R. (2005): *Deciding now what we want to be tomorrow as a key way of speeding the water business change* - IWA International Conference on Water Economics, Statistics and Finance, July 2005, Crete, Greece.[This is a keynote speech focusing the ongoing water business change that introduced the International Conference]

Parena R., Sanna F. (1999). *The Benchmarking Club of Italian water services: first results of an experience started in 1998*, 22nd IWSA World Water Congress, Special Subject 14, September 1999, Buenos Aires, Argentina.[This is a contribution presenting the results from an Italian Benchmarking project run by the National Association of water companies]

Parena R., Smeets E., Troquet I. (2002). *Process Benchmarking in the Water Industry*, IWA Manual of Best Practices, Iwa Publishing [This includes a methodology to widely adopt in practice to process Benchmarking the water industry]

Saghir J. (2003). *Innovative Options in the Public and Private financing of Urban systems: Moving Beyond the Public-Private Debate* - International Conference on Financing Water and Sanitation Services, November 2003, Washington D.C., USA.[This is a contribution presenting practicable options of public and private cooperation to finance water sector development]

United Nations, Department of Economic and Social Affairs, United Nations Development Programme, United Nations Economic Commission for Europe (2003): *Governing Water Wisely for Sustainable Development.* [This presents a comprehensive debate on sustainable development]

United Nations, Department of Economic and Social Affairs, Commission on Sustainable Development (2004). *OECD Global Forum on Sustainable Development: Financing water and environmental infrastructures for all*, Background paper n. 6. [This presents a comprehensive discussion of OECD debate on sustainable development]

Biographical Sketch

Dr. Renato Parena was born in Torino (Italy), in 1945, and graduated in Economics at the Turin University, in 1969.

He is Chief Financial Officer of the Group Società Metropolitana Acque Torino Spa, managing the water services (drinkable water, sewerage and wastewater treatment) in round 300 Municipalities of the Optimal Territorial Area of Torino, Italy, in which he has worked since 1969.

With over 39 years' experience in the water sector, he manages the financial sector of the Group and, as project leader, had particular responsibility for the privatization process of the previous municipal company into a publicly owned PLC, and then in further Merger and Acquisition activities that progressively led to the implementation of the Group.

He is member of the Boards of many sub-holding companies, and belongs to the Italian Association of Financial Analysts as chartered accountant and authorized auditor.

<u>In the water sector</u>

Renato plays an active role within the national water sector currently as a technical consultant to the Italian Federation of Water Services (Federutility).

At the international level he is an individual member of the American Water Works Association and an active named Italian representative at the International Water Association where he actually chairs the IWA Statistics and Economics Specialist Group and has been elected into the IWA Strategic Council.

He is author and co-author of many technical publications, papers and reports at national and international congresses, conferences, meetings and workshops (e.g. Hydrotop - Wasser Berlin - Aquatech - AWWA annual conference – IWA International Conferences) being involved, since early 1980’s, as Contributor or National Rapporteur in many IWSA and IWA Congresses.

He currently teaches economics and water charging topics at Hydroaid, the Torino based international non-profit association that in co-operation with the ILO is in charge for training in favor of the underdeveloped Countries, which need support for their development