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Socio-Economic Measures for Achieving Total Water Cost Recovery: A Brief Analysis with Illustration from the Evrotas River Basin, Greece

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Socio-Economic Measures for Achieving Total Water Cost Recovery: A Brief Analysis with Illustration from the Evrotas River Basin, Greece

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Abstract

The EU Water Framework Directive is considered a first systematic approach to ensure the quality of freshwater ecosystems holistically. At the core of the Directive is the concept of "Total" costs and benefits of water use, i.e. the financial, environmental and resource costs of water use. Many studies stress the importance of conceptualizing and monetizing the total water costs. Nevertheless, implementing total water cost recovery may raise social and redistributive concerns. We discuss the approaches to implement total water cost recovery with illustrations from the Evtoras River Basin in Greece. We argue that the measures might not work towards achieving total water cost recovery. We thus complement the analysis with a brief discussion of the socio-economic tools and instruments that policy makers may additionaly consider. We conclude with some policy recommendations and insights in support of well- informed policy making.

Keywords: Total water cost recovery; Programme of measures; Water framework directive; Sustainable management

Introduction

The EU Water Framework Directive (WFD) aims at addressing multiple stressors put on European Rivers. The WFD is considered a first systematic approach to ensure the quality of freshwater ecosystems holistically. Implementation challenges remain particularly with regards to capturing the "Total" costs and benefits of water use, i.e. the financial, environmental and resource costs. Many studies stress the importance of conceptualizing and monetizing the total water costs (e.g. [1-5]). Total water cost recovery links to the welfare economics literature which argues that for maximum economic efficiency, prices should be set equal to the marginal (Opportunity) cost. The allocative efficiency objective can also be advocated.

Allocative efficiency requires that all users face a clear signal regarding the value of water services. This can only be achieved if all costs are recovered through water pricing. In addition, the financial sustainability of operators is a prerequisite for the sustainable operation of water services. Core issues here regard the level of revenues and their predictability. Last total water cost recovery can be seen as a mechanism for producing revenue to compensate for the cost of environmental damage arising from water use.

Nevertheless, it is well recognized, both in the scientific literature and in most of national legislations, that implementing total water cost recovery may raise social and redistributive concerns which have to be addressed by public authorities. Also, it entails several steps from accurate cost-benefit estimations (Linked to the benefits agents receive from the use of water ecosystem services and goods, to environmental costs, to the financial costs and to the resource costs) to setting explicit investment and infrastructure projects and budgets. These steps are not easy to complete from a design, methodological and data availability perspective.

Acknowledging the importance of incorporating in water management the total costs and benefits of water use, EU polices attempt to incorporate integrated measures into water resources and river basin management. EU Member States have agreed to a series of measures that aim at the sustainable management of water resources that explicitly consider the total cost recovery of water i.e. ensuring that all costs involved in water use are recovered through securing funding or charging at a level which includes a relevant proportion of the financial, environment and resource costs. Article 9 of the WFD indicates that Member States may have regards to the social, environmental and economic effects of the recovery of costs. At Member State levels countries have put forward Programmes of Measures, including technical, non-technical, legal and economic measures that aim at capturing the total pressures and costs of water use.

This paper briefly reviews the Programme of Measures in the case of the Evtoras river Basin in Greece. Focus rests with the socio-economic measures included in the River Basin Management Plan (RBMP) in order to critically assess their design and socio-economic implications. The analysis indicates that the measures are in large general and abstract and underestimate the associated costs and benefits of water use. Also, the Programme does not provide enough information on how these measures are implemented and funded. The review points to the worrisome result that measures might not work towards achieving total water cost recovery in the Evrotas River Basin. We thus complement the analysis with a brief discussion of the socio-economic tools and instruments that policy makers may additionaly consider in their efforts to achieve total water cost recovery in the Evrotas River Basin. These alternatives come with advantages and shortcomings attached which should not be disregarded. These are brifly discussed with the intention to assist well informed policy making.

The remainder of the paper develops as follows: Section 2 discusses in brief the current status in the Evrotas River Basin and the socio-economic measures included in the River Basin Management Plan. Next section discusses alternative socio-economic measures for achieving full water cost recovery along with their main advantages and shortcomings. Last section concludes with some usefull policy implications.

Evrotas river basin: Current state and programme of measures for achieving full water cost recovery

The Evrotas River Basin is located in the south of Peloponnese, Greece. The river has a catchment size of 2240km^2. It is part (26.5% Approximately) of the greater river basin district of Eastern Peloponnese. The Evrotas River Basin area overlaps mainly with the Laconia Prefecture, but also includes small parts of Argolida and Messinia Prefectures. While the river basin includes many cities, Sparta is the largest. The Evrotas River Basin has a total population of approximately 82,500, of which 68,400 permanent residents (According the latest official census, 2011) and 14.100-second home residents and tourist overnight stays (184,800 in 2011).

The climate is typical Mediterranean with significant precipitation levels (total annual precipitation: 900 mm/year resulting in 2.031hm^3 or 2,0 Billion m^3 of water/year), with high fluctuation between the mountainous parts (800-1200mm/year, with 1600mm on the top of Taygetos mountain) and the lowlands/ coastal areas which receive considerably lower precipitation (400-600mm/year). Evapotranspiration level is estimated at 500mm/ year.

The region of Evrotas is characterized by cold winters and hot and dry summers. Regarding water sources, there is a total number of 61 water bodies where water can be abstracted from. The total number of water bodies account for: 100 surface water bodies (80 Rivers of a total length of 567.4km, 11 coastal water bodies of a total length of coasts of 1,106.1km, 1 lake of 1,23km^2 land cover and 6 transitional, covering a total area of 5.94km^2 and including lagoons and a river estuary) and 27 groundwater bodies primarily karstic or granular aquifers, identified to cover a total area of 8,064.1km^2, 19 out of the 27 are directly linked to surface waters or terrestrial ecosystems. The overall water balance in the region from the rivers is 918 million m^3/year total flows). One desalination unit operates at the stream basin of Argolikos Gulf, with a capacity of 4500m^3/ month.

Water needs in the Tripoli Plateau Basin and in the Stream Basin of Argolikos Gulf, are covered by groundwater abstractions and springs connected to the groundwater aquifer (accounting for 216,4 mil.m^3/year). Agricultural activities in the Evrotas River Basin depend primarily on surface water from the main bed of Evrotas and its confluents, via dams and direct stream flows. All other needs are covered by groundwater abstractions.

Based on data and estimations between 2006 and 2009, all water bodies except for one are in good condition both in terms of quantity and quality. On the other hand, it appears that a considerable degradation exists for freshwater bodies with regard to their chemical status, with 17 rivers having bad chemical status. However, most rivers are in moderate or good condition with regards to their ecological status. It is important to highlight that the status of 36 out of 49 river bodies is at risk. Three groundwater sources (two bodies for quantitative status and one for pollution status) are also characterised to be at risk.

The water supply and sewage services are considered in the case of Greece as a public service. In Eastern Peloponnese water is supplied by the Company for Water Supply and Sewerage (DEYA), inspected by the Ministry of Environment that approves the pricing policy. According to the River Basin Management Plan (2013), the pricing policy of DEYA in Eastern Peloponnese is differentiated into 4 to 7 categories. The pricing policy in the region is defined by priorities regarding local characteristics. The average price of water for consumption varies between 0.3 and 0.8€/m^3 and the price for water for irrigation ranges between 0.04 and 0.08€/m^3.

Pressures on the River Basin are mainly related to pollution. Groundwater pollution in the area is linked to agricultural activities. Increased levels of Fe, Mn, SO_4 have been measured, as a result of natural infiltration processes. In addition, there is Nitrate pollution (NO_3) due to the use of fertilisers in the agricultural activities. Industrial activities in the river basin district are related

to food production, primarily dairy and cheese products, and food processing (Meat processing, oil production, fruit and vegetable juice production) and a significant number of metal treatment plants and chemical industries.

In Greece the implementation of the cost recovery principle is very difficult. Water infrastructure in the domestic sector has been subsidized in large by the state. Koundouri find that total cost recovery on average for Evrotas river basin amounts to to 34.2%. At disaggregate level the total cost recovery for water supply is estimated at 37.89% while for irrigation is estimated at 15.66%. According to the Evrotas River Basin Management Plan (2013) the average revenues per m^3 of water for the entire water supply in the Eastern Peloponnese District was estimated at €0.72/m^3, whilst for the DEYA €0.85/m^3 and for Municipalities €0.53/m^3. Also the financial cost recovery is estimated to amount to 57.6%. Overall the analysis included in the River Basin Management Plan depicts a relatively low financial and total cost recovery for the Evrotas river basin, in line with the findings of [2]. The analytical data of the report show substantial differentiation among the various providers. In particular, recovery varies from 25% to 65%.

Several measures have to be implemented in the Evrotas river basin so as to achieve full cost recovery. This will have a significant impact on the market price as in its current levels the price fails to provide efficiency in the market and ensure sustainable management of the water bodies. In the attempt to achieve full cost recovery, it is expected that agricultural users will be faced with the largest increase in water costs. With regards to specific measures included in the River Basin Management Plan a summary of main targets, cost estimations and impact assessment for the Evrotas River Water Body summarized in Table 1. Lack of data does not allow to undertake a detailed quantitative cost-benefit and cost effectiveness analysis but to do an overall assessment of expected outcomes. In the River Basin Management Plan are not detailed specific measures to address full water costs but just general measures that address specific goals mainly related to pollution and erosion control. Thus, we are unable to estimate the allocation of full cost recovery burden among agents and sectors in the region. Nevertheless, given the socio-economic characterisation of the region (important agricultural sector in terms of Gross Value Added and employment, limited industrial production, low population density but with seasonal variability) it can be argued that the main effects of achieving total water cost recovery are expected to be recorded in agriculture.

Table 1: Socio-economic measures for the Evrotas River Basin.

Socio-Economic Measure	River Basin Management Plan Impact Assessment (Costs in Euro)	Cost-Benefit and Cost Effectiveness Assessment
Recreation and restoration of wetlands areas: Enhancement of monitoring facilities/infrastructure for biotic and abiotic parameters of river estuary, in view of identifying the ecological flow at the river estuary based on biotic and abiotic indicators of the transitional Water Body. Competent Authority: Region	Investment cost: 3,000 Operation cost: 0 Social impact: Negligible Financial Impact: Negligible Environmental impact: Negligible	Given the low investment costs foreseen it can be anticipated the measure to have no effects on the costs of water use (i.e. through an increase in the water prices so as to cover the costs of the measure). In terms of affordability the cost of the measures will not put pressure on access to water and ability to pay for water. The financial impact might be negligible; nevertheless, the environmental and social impact might be considerable. This impact is expected to be high not in terms of financial costs but in terms of the non-monetized effects (e.g. benefits that the society enjoys due to access to improved ecosystem services and goods provided by water ecosystems). Also, the environmental benefits might be considerable due to improved environmental status and this can add more value to the benefits agents get from access to better ecosystem services.
Works of research, development & presentation of best practices: Enhancement of infrastructures monitoring waters, inflow of fresh water as well as the movement and behavior of streams. Competent Authority: Region	Investment cost: 10,000 Operation cost: 0 Social impact: Negligible Financial Impact: Negligible Environmental impact: Negligible	Low investment costs are expected to put insignificant pressure on the affordability of agents of water costs due to higher prices. The benefits are expected to spread across different sectors and categories of users (households, industry, agriculture). Impossible to distinguish the main funders of the measure as the Competent Authority remains the Region and it is not clear whether funds will come from national funding, private funding or EU funding. The costs (social, financial, environmental) are not high but the benefits should be considerable with regards to social welfare and environmental improvement. These benefits spread across the entire range of agents making use of the ecosystem services and goods provided by Evrotas river and should be proportional to the extent of their use.
Structural construction works: Rational wastewater management by settlements with population peak <2000 PE (priority D agglomeration) Competent Authority: Region	Investment cost: 1,500 Operation cost: 0 Social impact: Negligible Financial Impact: Negligible Environmental impact: Negligible	The financial costs of the measure are negligible and should not put pressure on water prices and affordability faced by different users. Nevertheless, the social and environmental costs might not be negligible as the construction might impact on the social welfare and/or the environmental status in the area of the infrastructure. The costs cannot be estimated due to lack of detailed information on the measure. Construction works might impact disproportionally on the costs borne by different agents (households, industry, tourism sector etc.).

Abstraction control: On-site inspections at authorized/licensed water abstractions. Competent Authority: Region	Investment cost: 0 Operation cost: 0 Social impact: Negligible Financial Impact: Moderate Environmental impact: Negligible	The investment and operational costs of the measure are zero according to the River Basin Management Plan. Nevertheless, the measure is associated to administration and management costs that are not reported. They might form already part of the regional authority budget and spending nevertheless in order to make an accurate analysis and efficient use of alternative policy options this cost needs to be compared to the benefits resulting from the measure. The social and environmental costs are negligible, but the benefits are considerable if "free-riding" effects and illegal excessive abstraction is captured. Affordability issues are associated to agents caught for unauthorised water abstractions. The impact might be significant for households and agricultural producers making use of unauthorised abstractions. If implemented in full the measure can eliminate "free-rider" effects.
Other relevant measures: Further investigation as regards the measurements and causes of excessive chemical substances recorded in the Water Basin. Competent Authority: Decentralized Administration (Direct. for Water)	Investment cost: 3,000 Operation cost: 0 Social impact: Negligible Financial Impact: Moderate Environmental impact: Negligible	Low investment costs will have marginal impact on water prices. The cost of the measures will not put pressure on access to water and ability to pay for water. The financial cost is negligible for the competent authority but can be important for the agents polluting the water body. If appropriately applied this can lead to full implementation of the "polluter pays" principle. As a result of this the environmental and social impact might be considerable. The social benefit of these measures can be considerable given the non-monetized effects (e.g. benefits that the society enjoys due to access to improved ecosystem services and goods provided by water ecosystems). The environmental benefits can be considerable due to improved environmental status.
Penalties for illegal sand extraction	Investment cost: 3,000 Operation cost: 0 Social impact: Negligible Financial Impact: Large Environmental impact: Negligible	The measure comes with a low investment cost and zero operational cost. As this is mainly a legislative measure it appears strange that this measure comes with an investment cost and no operation cost. It would be rational to expect some management and or administration costs related to the measure that reflect the labour costs, the inspection costs, communication costs, etc. related to the measure. These costs should not be significant and are not expected to have a significant impact on water prices and affordability. The financial impact is characterised as high in the River Basin Management Plan. Nevertheless, this depends on the amount of the penalties set by the legislator (no information provided in the River Basin Management Plan). Also it is not clear how this penalty is set and what are the cost ranges (e.g. will an individual pay a fixed amount irrespective of income? Or will the penalty be monetized based on the estimates on the environmental/social damage related to illegal sand extraction?). The benefits of the measure cannot be quantified as there is no monetized information of the effects of sand extraction.

Source: River Basin Management Plan of Eastern Peloponnese, and authors' elaboration.

From the review of the measures the following comments arise:

A. The measures are general and underestimate the associated impact and costs. It is estimated that measures come with no operational cost or marginal impact nevertheless no adequate documentation of the reasons reaching to this conclusion is given.

B. The measures lack a clear explanation on how they are going to be implemented. Thus, it is impossible to assess in cost-benefit terms or to assess who is going to be the end beneficiary or the agent bearing the cost of these measures.

C. No information is provided with regards to the estimation of investment costs and particularly with regards to the discount rate applied. Thus, it is not accurately estimated the impact of the effect as no Net Present Value inferences or calculations can be made due to lack of data.

Socio-economic measures for achieving full water cost recovery and implications for policy making

Full cost recovery is not achieved in the Evrotas River Basin and the socio-economic measures included in the River Basin Management Plan seem inadequate to address sustainable management targets. So, it is usefull to discuss in brief the alternatives that policy makers have at reach for achieving full water cost recovery, along with their advantages and shrtomings. The literature offers a wide range of studies on the economic tools and alternatives to fair and efficient allocation of natural resources with particular focus on water (see [6-16])[1]. Drawing on the existing literature, the main tools and their characteristics are briefly discussed next and summarized in Table 2 along with their main advantages and shortcomings.

Table 2: Socio-economic instruments for achieving total water cost recovery and efficient water management.

Instrument	Benefits	Costs
Standards and Quotas	Ease of application	Economic efficiency my not be fully achieved
Water abstraction/ Pollution charges	Adjustment of price signals to reflect actual resource costs; Encouragement of new technologies; Flexibility; Generation of revenues	Incorrect charge levels may lead to over-utilization of resource
Subsidies	Ease of application	Economic efficiency my not be fully achieved
Tradable permits	Quantity based targets that are able to attain least-cost outcome; Flexibility	High transaction costs
Voluntary agreements	Readily acceptable	Monitoring/binding difficulties

Water abstraction and pollution taxes can be statically and dynamically efficient and trigger innovation. Area pricing is probably the most common form of water pricing whereby users are charged for the water used. Other less commonly used forms of taxes include output (charging a fee for each unit of output produced per user) and input (charging users for water consumption through a tax on inputs, e.g. fertiliser purchased) pricing. Taxation effectiveness is associated to institutional factors as well as to the administrative and monitoring capacity of the setting body.

Subsidies can be another optional economic tool, directly implemented for water-saving measures to induce users to behave in a more environmentally friendly way. Alternatively, indirect subsidy schemes such as allowances may also be implemented. Subsidies may be inefficient by distorting incentives or adoption of novel technologies. An alternative could also be standards and quotas, which are legally set binding restrictions on natural resource use. Such instruments remain effective if users are faced with substantial monetary penalties. Similarly, to subsidies, sandards and quotas may be effective to the extend they impact on incentives for water consumption.

Another policy option is the allocation of tradable permits. The rationale behind water allocation through tradable rights is that in a perfectly competitive market, permits will flow to their highest-value use. Different types of tradable permit systems can be established including water abstraction discharge and use rights. On a more voluntary basis, policy makers can also consider voluntary agreements between different local users and stakeholders where parties can bargain about compensation payments. The allocation of such payments depends on the assignment of rights.

Last, policy makers may consider environmental liability systems that can internalize and recover the costs of environmental damage through legal action and make polluters pay for the damage their pollution causes. If the penalties are sufficiently high, and enforcement is effective, liability for damage can provide incentives for taking preventative measures. For such systems to be effective there need to be one or more identifiable actors (Polluters), the damage needs to be concrete and quantifiable and a causal link needs to be established between the damage and the identified polluter.

We discuss next in brief the cost-benefit and cost effectivenss implications of the socio-economic approaches presented above. The analysis evolves around affordability issues, ease of application, accuracy in achieving the policy targets and fairness in allocating the cost among different agents. This is also linked to adherence to the "Polluter Pays" principle. Table 3 summarizes the main findings in terms of cost-benefit and cost-effectiveness analysis.

Table 3: Costs, benefits and effectiveness of selected socio-economic measures for achieving full water cost recovery

Socio-Economic Instrument	Administration and Management Costs	Ease of Application	Accuracy of Achieving the Target	Adherence to "Polluter Pays Principle"	Speed of Impact	Possibility of Inducing Distortions in the Market
Standards and Quotas	+++	+	+	+	+	+++
Water abstraction/ Pollution charges	+++	+	+	++	++	+++
Subsidies	+++	+	+	+	+	+++
Tradable permits	+	+++	+++	+++	+	+
Voluntary agreements	++	++	++	+	+	+

Notes: +: Low, ++: Medium, +++: High

On the cost side the economic instruments come with administrative costs that vary from relatively high in the case of monitoring standards and quotas to relatively low in the case of tradable permits. While in the former case the legislator needs to closely monitor the eligibility criteria and the end recipients/ beneficiaries of standards and quotas, in the latter case the only administrative cost is related to establishing the permits to be traded and then just the update of the virtual or physical place in which the trading takes place. The administrative costs can also be high in the case of abstraction and pollution charges or in the provision of subsidies. Here the costs are associated with close monitoring and regular need for updates on the status and eligibility of end-beneficiaries/eligible agent.

An additional cost to the application of different socio-economic instruments for achieving full cost recovery is related to the possible distortions induced in the market. While the starting point and end goal of using such instruments is to restore market efficiency, the final result might be quite different. Uncertainty related to the discount rates employed, to the future economic conditions, to assumptions on sectoral development etc., may result in over-estimation or under-estimation of the degree of intervention in the market leading to over-or under-correction of the market inefficiencies.

On the benefit side the economic instruments put forward come with the advantage and benefit of ease of application, speed of impact and fairness in burden allocation. In some cases, like in the case of tradable permits these benefits might be relatively high while in the case of other instruments like use of standards and quotas or subsidies the benefits can be low. This outcome is related to the design of the instruments and to the effectiveness of their application. In terms of fairness of allocation of the costs, tradable permits might be proposed as the best alternative as market driven forces of demand and supply distinguish the polluters from the non-polluters, but in the case of standards, quotas and subsidies, fairness in cost allocation depends on the capacity of the legislator or the administrator to distinguish between the polluters or the non-polluters and to allocate the burdens in a fair way.

Overall it can be argued that the instruments to integrating the externalities in the market for natural resources and to address market inefficiencies vary in terms of the practicalities attached to each alternative and on their effectiveness. From a theoretical perspective all the economic instruments discussed above can be proposed to be used in a complementary manner in order to achieve sustainable river management. In each case though it has to be communicated clearly the advantages and the shortcomings attached to each alternative economic instrument and this to be matched to the particularities of each case, to the severity of the problem that needs to be addressed and to the particular social and economic conditions prevalent in the policy site of interest. Thus, the final selection has to be based on stakeholder priorities and well-informed science evidence-based dialogue.

Concluding Remarks

The sustainable management of water necessitates efficient market prices that incorporate the total costs and benefits related to water use. For this purpose, EU Member States are called to implement specific Programmes of Measures taking into account affordability and equal access to resource implications. At the same time the economic implications of total water costs have to be taken into consideration including impact on sectoral production (Especially in Agriculture) and regional economic development. The socio-economic assessment of the Programme of Measures, as illustrated with the example of the Evrotas river basin in Greece, has to overcome significant data limitations and non-clear description of the measures included in the River Basin Management Plans. This lack of information and quantitative data limits the cost-benefit insights but also indicates the areas where policy efforts and recommendations need to put focus on. Indicative recommendations include:

A. Demand for greater transparency and detailed information on the measures and the investments planned by the Member States in order to achieve the goals of the WFD.

B. Detailed analysis and breakdown of the cost estimations including analysis of administration and management costs, operation costs and discount rates.

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