Chapter 2
Water Pricing and Taxes: An Introduction

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Abstract Water pricing embraces a range of distinct policy instruments that affect the scale and/or the pattern of production and *resource*-exploitation costs. Ideally, water prices should reflect *financial costs* of service delivering water infrastructure, *environmental costs* arising from harm induced to ecosystems and ecosystem services, and *resource costs* attendant to social welfare losses from not using the water for the most socially beneficial purpose. What is straightforward and unchallenged in economic theory may not translate into clear and uncontested principles to be followed in practice. The information asymmetries, pre-existing water permits or entitlements adhering to different legal doctrines, and hostile reception of water policy reform may antagonise introduction of pricing policy instruments. This chapter provides an overview of the empirical studies from different European countries, supplemented by studies from California and Israel, comprised in the first book section. Although the collection is not meant to be exhaustive or thorough, it offers insightful overview of design principles and choices made to put in place a variety of instruments designed to cope with water pollution, water stress, and hydrological and morphological modifications of water bodies. The majority of the chapters in this section addresses residential and industrial water supply provision and wastewater discharge. The remaining chapters examine the application of EPIs in agriculture, for cost recovery of irrigation services and pollution control; and in hydroelectricity generation, for curbing the environmental impact of water impoundments. The common structure of all showcased studies is a result of meticulous efforts to highlight the scope of the analysed instruments, the embedding legislative and regulatory environment, and the evidence collected so as to substantiate the performance assessment.

Keywords Water pricing • Cost recovery • Water Framework Directive (2000/60/EC) • Environmental taxes • Subsidies

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2.1 The Role of Water Prices and Taxes in Water Policy

Water pricing embraces a range of distinct policy instruments that affect the scale and/or the pattern of production and *resource*-exploitation costs. Staged by means of *incentives* (i.e. subsidies) or *disincentives* (i.e. taxes or charges), these instruments eventually affect the price paid for goods or services that either make use of water resources or otherwise affect natural water bodies. Characteristically, pricing instruments are put to use to rectify *market failures* that arise when social costs or benefits of production and consumption are not reflected through prices determined by *free* markets.

Water is notoriously known as both, an economic and social good; essential for life, economic development, social cohesion, and the environment. The multitude of the at least to some extent incompatible uses of water and their impacts on natural water bodies makes public water policy choices both value-laden and *intractable*. What is more, availability of water is unevenly distributed over time and space, implying that there is not enough water to permanently or temporarily satisfy all demands. As a result, economic costs of water and water services, that should ideally be reflected in the price users pay for them, is a combination of *financial costs* of service delivering water infrastructure, *environmental costs* arising from harm induced to ecosystems and ecosystem services, and *resource costs* attendant to social welfare losses from not using the water for the most socially beneficial purpose. With other words, designing pricing instruments for a sustainable water management is as challenging as are the public choices themselves about what is the appropriate and sustainable way of managing water resources.

To qualify as *economic policy instruments* (EPIs, see also Chap. 1), price interventions ought to deliver discernible *environmental* improvements in regard to the predetermined water policy objectives. This is only the case if the demand for water or water services is elastic, that is when the quantity demanded of a good or service responses to a change of its price. Notably, *price elasticity* depends on a host of factors, including the income and availability of substitutes. It has been demonstrated in numerous instances (Mansur and Olmstead 2012; Olmstead et al. 2007; Olmstead and Stavins 2009; Olmstead 2010), including the studies featured in this book, that although demand is *relatively inelastic*, it is nevertheless different from zero. This implies that sizeable changes in demand require considerable price adjustment. If the demand was *entirely* inelastic, demand for water and water services would not respond to price intervention and pricing instruments would merely serve *financial purposes*, i.e. generating revenues. But even in that case, if the revenues were earmarked for implementing measures helping to safeguard the environmental health of water bodies, pricing can contribute to accomplishing public water policy goals.

What is straightforward and unchallenged in economic theory may not translate into clear and uncontested principles to be followed in practice. The information asymmetries, pre-existing water permits or entitlements adhering to different legal doctrines, and hostile reception of water policy reform may antagonise introduction of pricing policy instruments. As a consequence and despite the sound theoretical foundation, the experiences reported in this book still mark rather early stages of managing water as an economic resource. Accordingly, the 2012 EU Water Policy Review[1] lamented a limited application of '*incentive and transparent water pricing*', concluding that '*not putting a price on a scarce resource like water can be regarded as an environmentally-harmful subsidy*' (EC 2012, p. 10). Noting the practical difficulties and the necessary mind-set change, we argue that the policy analysis should not be centred only on how much water and water services should be priced in principle, but rather how water prices should be designed so as to best respond to the challenge of managing water resources effectively. This shifts the emphasis away from the determining the optimal price levels alone to choosing the pricing schemes and combination of instruments that are tailor-made for the specific policy contexts, taking due account of the existing institutions and competing policy objectives.

This *book section* features a compilation of empirical studies, organized in separate chapters that examine applications of water pricing instruments in different European countries, member states of the European Union (EU), which are supplemented by noteworthy studies from California and Israel.

Although the collection is not meant to be exhaustive, it offers insightful overview of design principles and choices made to put in place a variety of instruments designed to cope with water pollution, water stress, and hydrological and morphological modifications of water bodies. More than that, all analysed instruments are explored in the same way, making sense of all available evidence in support of assessing the instruments' environmental, economic and social outcomes. The majority of the chapters in this section addresses residential and industrial water supply provision and wastewater discharge. The remaining chapters examine the application of EPIs in agriculture, for cost recovery of irrigation services and pollution control; and in hydroelectricity generation, for curbing the environmental impact of water impoundments. The common structure of all showcased studies is a result of meticulous efforts to highlight the scope of the analysed instruments, the embedding legislative and regulatory environment, and the evidence collected so as to substantiate the performance assessment driven by the framework outlined in the Chap. 1.

The *Polluter Pays Principle* (PPP), already featured in the First *European Environment Action Programme* (1973–1976), made its way into the EC Treaty in the 1987[2] and successively in the secondary European legislation (e.g. Water Framework Directive 2000/60/EC, the Directive on Industrial Emissions 010/75/EU). The effluent tax in Germany (Chap. 3), introduced in 1976, was among the first applications of environmental taxes in Europe implementing the PPP. The tax that is still applied to the authorized discharges is calculated in terms of damaging units,

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions *A Blueprint to Safeguard Europe's Water Resources* COM (2012) 673 final.

[2] Article 130r of the *Single European Act* (SEA). In the currently in force Lisbon Treaty the PPP is covered by the Article 191(2) of TFEU.

estimated as the equivalents of ten contaminants. The water load tax in Hungary (Chap. 4), introduced incrementally shortly before Hungary joined the EU, operates in a similar way. The tax is determined by nine contaminants contained in the discharged wastewater, but unlike the German tax it takes into account the environmental sensitivity of the receiving environment and the way the sludge is eventually disposed. In both cases the municipal wastewater disposal is the most affected sector and the tax is eventually paid by households as the final consumers. The taxes contributed to an earlier implementation of the *Urban Waste Water Directive* (91/271/EEC) among others by allowing that the polluters' investments into better wastewater treatment was deducted from the amount of tax due. While in Germany the tax revenues are earmarked for pollution control executed by the state authorities, in Hungary they contribute to consolidating public finances.

The Danish pesticides tax (Chap. 6) was designed to protect the surface and groundwater bodies, the latter being source of drinking water provision usually without treatment, and to contribute to fulfil the objectives of the Danish pesticide policy. It replaced the previous general tax levied on pesticides wholesale prices that proved unable to curb the use of pesticides. Implemented as a product tax, levied on the sales prices, the instrument differentiates the categories of use, rather than the toxicity levels. Designed in revenue-neutral way, the collected tax revenues are reimbursed to farmers through lower land taxes and subsidies for organic and environmentally friendly farming. In doing so, the design of the tax is amenable to the principles of environmental tax reform.

The design of water tariffs for residential water uses is particularly intrigued as it is often called to conciliate solidarity principle of affordability of water service provision for economically disadvantages households (ability-to-pay principle) with principles of full economic cost recovery and efficient use of resources. The studies of water tariffs analysed in this book complementary to some extent. In all cases the tariffs are designed so as to recover financial costs of the service provision, and discourage *disproportionate* (beyond what is understood as reasonable) use of water resources.

Chapter 8 shows how this reconciliation was accomplished in the residential water pricing scheme in the *Emilia Romagna* administrative region (Italy). As a natural monopoly frequently managed through *concessive model* exemplifying the *public-private* partnerships, the organisation of residential water supply and sanitation services (WSS) and the water tariff setting are narrowly regulated. Amidst the institutional reform implemented since the 1990s, the administrative region of *Emilia Romagna* waged a modification of tariff method in a way that rewards a better service and environmental performance of water utilities, and in contrary, penalises utilities whose performance is judged substandard. The rewards and penalties aimed at utilities and could not be passed on to the final consumers. The modified tariff system also privilege economically vulnerable households by cross-subsidising their water consumption by higher price levels in the upper tiers of the increasing block tariffs.

The application of increasing block-rate (IBR) water budgets in three water districts in southern California, covered in the Chap. 11, applies similar tiered price structure but pioneers tailor-made block sizes specific for households characteristics and environmental conditions. Prompted by equity issues and financial viability of water utilities, the reform of water tariffs involves specification of a reasonable use of water in the first (indoor) and second (outdoor) block, the consumption beyond which is deemed inefficient (third block) or even excessive (fourth block). The *reasonable use* of water is determined by state regulation (e.g. around 200 l per day and household member), empirical evidence (e.g. real time monitoring of evapotranspiration), and individual household/property information (e.g. irrigated area). Whereas the revenues collected from the first two block rates and the fixed component of the tariff are design to recover the financial costs of the service provision, the penalising tariffs for the water use beyond what is considered reasonable is destined for exploitation of additional or alternative water sources.

Volumetric water tariffs may play perhaps even more important role in agriculture, especially in temporarily or permanently water stress countries in the Southern Europe. Chapter 9 brings this to the point by analysing empirical evidence from the *Tarabina* irrigation district in the Emilia Romagna administrative region (Northern Italy). The irrigation districts relies on water supplied by the *Canale Emiliano-Romagnolo* (CER), which is one of the largest water transfer projects in Italy, from the Po river. Although Po river (basin) is usually water abundant, recent prolonged drought spells (2003, 2006–2007) have induced water shortages that prompted water restrictions throughout the river basin. The volumetric water tariff was introduced both as a mean to foster both, water re-allocation to higher value uses during periods of restricted water supply, and a more equitable distribution of irrigation-related costs among the farmers within the irrigation board. The volumetric tariff resulted in a demonstrable reduction of about 50 % of water demand on average, and a sizeable reduction of costs for farmers who irrigate less or do without.

The subsidies-related EPIs in this book are represented in this book by Chaps. 5, 7, and 13. These studies address different policy goals. In Cyprus study (Chap. 7), the subsidies were meant to restrain domestic demand for potable water by encouraging greater use of alternative water sources, from aquifer or recycled wastewater. The assessment of these subsidies yielded mixed results. Although a limit was imposed on groundwater abstraction for newly installed borehols, the weak monitoring of the actually abstracted water might have increased the pressure of the aquifers. Hence although the subsidies contributed to restructure outdoor water demand, especially during the extreme 2007–2008 drought, it is not obvious to what extent they contributed to greater water conservation. On opposite side, the subsidies did not succeed to stimulate larger interest in wastewater recycling that would have generate long-lasting reduction of water withdrawal.

The compensation payments for less intense agricultural practices in vulnerable areas are discussed in Chap. 5 as a part of a bundle of policy instruments addressing nitrate water pollution and untenable water abstraction. First pursued as a partial compensation for production losses prompted by strict regulation in the water protection areas, the subsidies were later extended, under different design, to other areas in which nitrate pollution persist. The water abstraction charge complements the policy mix, especially after the revision in 2010 that reinforced the incentives to conserve and protect water resources and incentivised investments by large water users.

Yet another subsidy scheme from Germany, presented in Chap. 13, revisit the economic incentives of hydropower producers to reduce the environmental impacts of water impoundments through higher remuneration for electricity produced. Introduced in 2004, the scheme bears a resemblance to feed-in tariff, further explored in the next chapter on example of Italy. The schemes guarantees an incentive price for hydropower supplied from plants with better environmental performance, specified by considering plant's design criteria (storage capacity, biological passability) and management practice.

The Chap. 12 wraps up the collection of pricing related instruments, by reviewing a mix of EPIs designed separately but all acting together in a way hydropower potential was exploited in Italy. Feed-in tariffs (FIT) and especially tradable green energy certificates (GEC) had been introduced to build supply-side competition among the RES and to curtail the costs of renewables. The actionable concession award or operating large hydropower plants are an opportunity to coerce environmental improvement. The chapter goes on to discuss the roles of water abstraction fees and charges that can be designed in a way that is sensible to the environmental impacts, and at the same time limit the development of hydropower in less or not suitable places.

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