Chapter 14
Water Trading: An Introduction

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Abstract Rather than setting water prices and leaving quantities to economic agents, water authorities may rather choose to cap water quantity and set the necessary conditions for voluntary trades to happen. From a wider perspective of water use (one not only constrained to water withdrawal and consumption but also to the disposal of polluting substances), water rights or entitlements could also be defined as pollution credits and be traded in water quality trading (WQT) schemes. This chapter presents a wide array of experiences both on water quantity and water quality trading. A successful experience on nutrient credit trading in the Great Miami River (Ohio, USA) is presented along with a non-fully successful one in North Carolina, from which insightful lessons can be drawn in terms of optimising the incentive design. Furthermore, a salinity offsetting scheme in Australia is also analysed. In terms of water quantity trading, incipient experiences in central Spain (Tagus river basin district) are analysed together with mature and dynamic experiences of deep markets in Chile, the Murray-Darling Basin (Australia) and Colorado (USA).

Keywords Water rights • Water markets • Water trading • Water quality trading • Offset schemes

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14.1 The Role of Markets and Trading in Water Policy

As an economic policy instrument, water (use right) trading entails a voluntary transfer of a quantifiable water allocation, either to be withdrawn or polluted, between a buyer and a seller (Hodgson 2006; Hanemann 2014; Shortle 2013). These two parties enter into a transfer agreement only if and when it is in each party's interest. Water trading is an adaptive management instrument in the sense that, unlike regulation and mandates, it is a flexible economic incentive to fit new and emerging water uses over time (Rosegrant et al. 2014). Further, it is a de-centralized mechanism in the sense that users themselves make decisions on water use so that local conditions and ad-hoc needs are accommodated (Garrick et al. 2013; Colby et al. 2014; Young 2014).

Water trading schemes, as a response to water scarcity and drought risk (Debaerea et al. 2014) have been pervasive in the recent economic literature, even if such schemes are not widespread in the world (let alone in Europe).

Major experiences in water quantity trading are necessarily a driver for research in this area. As a result of that, the Murray-Darling Basin in Australia can be said to be a lab for water trading and steadily yields peer-reviewed articles and other academic work in this research area (see, for example, Docker and Robinson 2014; Grafton and Horne 2014; Grafton et al. 2014; Grafton 2010; Kirby et al. 2014; Loch et al. 2014; Wheeler et al. 2014a, b). Something similar happens in Chile (Wagnitz et al. 2014; Hearne and Donoso 2014; Donoso et al. 2014) or the USA western states (Howitt 2014; Ghosh et al. 2014; Goemans and Prichett 2014).

Besides, literature on water trading is quite diverse. Water trading is perceived as a contribution to water security (via supply reliability) (Colby et al. 2014) and a fertile space to reflect on institutional reforms, water policy design, and transaction cost analysis (McCann and Garrick 2014; Erfani et al. 2014), but also as an economic instrument to tackle water quality concerns (Keller et al. 2014). There is also a wealth of references, from a microeconomic perspective, on farmers' decisions and exposure to risk (Loch et al. op. cit.; Wheeler et al. 2014b; Zuo et al. 2015; Lafreniere et al. 2015) or the effects of alternative irrigation institutions (Ghimire and Griffin 2014). Yet, whilst many authors focus on the economic instrument itself (water trading), others rather explore their different delivery mechanisms (types of trades): see, for instance, Howitt (2014) and Broadbent et al. (2014) on lease contracts or Hansen et al. (2014) on valuing options.

Over the last few years, a number of cross-country analyses on water market activities have been published, always biased towards institutional issues (Hadjigeorgalis 2009; Grafton et al. 2010, 2011). As above, most of the relevant experiences are found in mature markets, such as those in the Murray-Darling Basin (Australia), northern Chile, and the semi-arid states of the western US. Just minor experiences can be found in water markets, to a different extent, in countries such as China, India, South Africa or Spain.

In terms of water quality trading, most experiences can still be found in Australia, the USA, Canada, and New Zealand (Shortle 2013; Greenhalgh and Selman 2012; Keudel 2007).

As Delacámara et al. (2015) point out, water quantity trading in Europe is only in its embrionary state, despite the emphasis of the EU Blueprint to Safeguard Europe's Waters [COM (2012) 673] highlighting the policy interest of water trading as a means to tackle water scarcity and drought risk. Experiences are mostly restricted to some Mediterranean catchments in Spain (Kahil et al. 2014; Garrido et al. 2012; Gómez et al. 2013) and also to somewhat bounded upstream markets in England and Wales (OFWAT 2010; Mitchell and McDonald 2015). In France and, to a lesser extent, in Italy – the latter not yet being supported by national legislation – the status could be described as expectant or, at best, as exploratory.

As per water quality trading, Europe offers "much ado about nothing" or, to put it in a different and more positive way: a huge number of opportunities and not too many facts to date. Wind (2012) when developing an overview, found experiences in Sweden (based on Collentine 2006), Finland (Lankoski et al. 2008), the Baltic Sea (Hautakangas and Ollikainen 2011), Belgium (Klooster et al. 2007), or the Netherlands (Oosterhius and Peeters 2014) All those experiences, though, could be arguably said to be at an experimental stage (i.e. simulations, etc.).

14.2 Water Trading Experiences

The reader will find in this part of the book the following experiences both on water quality trading (Ohio and North Carolina, USA), salinity offset schemes (Australia), and water quantity trading in the Tagus watershed (Spain), Chile, the Murray-Darling Basin (Australia), and Colorado (USA).

In Kieser and McCarthy (Chap. 15), a nutrient credit trading scheme is presented. Nutrient credits were traded between five wastewater treatment plants (WWTPs) and hundreds of diffuse pollution sources (farms) in the Great Miami River, a tributary of the Ohio River (USA). An interesting institutional setup, whereby a watershed-based flood control agency managed a water quality trading (WQT) programme, led to a cost-effective option for WWTP compliance. The WQT scheme includes a specific incentive design (i.e. a reverse auction for securing lowest-cost credit contracts for farmers) that partly explains the success of this programme, one of the ambitious ones in the USA.

Yates (Chap. 16) analyses a nitrogen trading scheme in the Neuse River catchment (North Carolina, USA). In this case, the cap-and-trade programme (setting a mandatory threshold and allowing for trade to comply), WWTPs were allowed to sell or temporarily lease their permits to other plants. Whereas the economic policy instrument managed to meet environmental targets (i.e. abating emissions against baseline), the author argues that it failed to meet an economic objective (i.e. reducing emissions in the least-cost way).

Most interestingly, in what could virtually provide insights on the link between water quality and water quantity trading, Ancev and Azad (Chap. 17) analyse a salinity offsetting scheme. Salinity levels, a major concern in water scarce and drought prone areas, are naturally significantly higher in downstream river sections. As water quantity trading results, at least for countries such as Australia, in large movements of water to downstream areas, in-plot water use may increase groundwater seepage to rivers, thus increasing in-stream salinity levels. This is far from being the only reason to explain higher salinity levels; yet, it has a major potential to draw conclusions in some arid and semi-arid regions of the world where water trading might be explored as an option. Ancev and Azad assess the impact of three offsetting programmes designed to mitigate irrigation-induced salinity in Australia. Salinity offsets are designed to compensate for salinity impacts from a given agricultural activity through a commensurate reduction of salinity impacts elsewhere. In other words, it can be seen as a compensation mechanism.

Trading pollution permits thus require the creation of pollution entitlements subject to property rights. They benefit from the existence of drivers inducing action at the local level, such as national legislation, definite pollution standards, and the possibility of external intervention if lacking local action. The existence of a "champion" i.e. of a well-defined institutional focal point promoting, overseeing and facilitating the activity is essential. They also require institutional cooperation and stakeholder participation. Likewise, salinity offsets in Australia can also be seen as an example of burden sharing in the presence of economic incentives.

Within the context of water quantity trading, Delacámara et al. (Chap. 18) analyse two specific, small-scale water trades in the Tagus River watershed in Central Spain. Given the incipient status of water quantity trading in Spain, the main interest of these two trades is that they can be considered as some of the first experiences in the country, always linked to drought events and providing clear economic incentives to involved parties. The Spanish water legislation was amended in 1999 to allow for the transfer of water rights, which in Spain take the form of and administrative license or concession and are mainly traded through lease contracts. The experience analysed in Chap. 18 shows how Greater Madrid metropolitan area managed to overcome structural water constraints during drought events through voluntary agreements to trade water from agriculture to urban uses.

The immature experience in Spain contrasts with deep markets in Chile and, above all, the semi-arid states in the USA and the Murray-Darling Basin in south-eastern Australia.

Donoso (Chap. 19) analyses the Chilean water trading experience. Chile, likewise Australia, defined a water right system based on nominal entitlements. As in the Australian case (presented in Chap. 20 by Young) the Chilean water trading model can be said to have succeeded in terms of harnessing the economic potential of water (for instance, with a major expansion of irrigated land for an export-oriented economy) whereas raising doubts in terms of its environmental outcomes. Chile can be said to be an approach to water trading that has taken up to a fever pitch the notion of private water use rights. Markets have driven investment given the high level of legal security attached to right allocation. Yet, concerns remain as to legal security of some rights (i.e. Copiapó Valley) is supported by water availability given the evidence of overexploitation.

Probably the most active water markets in world are located in the Murray-Darling Basin (Australia) where most of the trade occurs between agricultural users. Young (Chap. 20) does not present a comprehensive nationwide overview of the Australian model but rather an analysis of an interesting milestone in water policy reform in the country: the unbundling of the licensing system. Unbundling sheds light on one of the necessary conditions for the development of market-based approaches to sustainable water management: allowing people to hold water licenses without owning any land.

Last but not least, Howe (Chap. 21) assesses the renowned experience of the Northern Colorado Conservancy District (NCCD) in Colorado (USA). This case would be somewhat difficult to transfer to other realities, given the massive support via subsidies for a major diversion project to make water available for a large irrigation district. However, many lessons can be drawn from its analysis. The NCCD market is the most active water market in the USA in terms of number of transactions per year, due to relatively low transaction costs that stimulate frequent small trades.

Overall, the reader of this book will have access to a very wide diversity of water trading schemes. Water trading has proved to be an instrument to re-allocate water from lower- to higher-value economic activities (notably in Chile, the Murray-Darling Basin and Colorado), providing a clear signal, under appropriate conditions, of the value of water but not necessarily encouraging conservation in all cases. As an economic policy instrument, water trading elicits to water users the opportunity cost of their decisions through setting a price and making market incumbents (and others, in some national legislations) aware of the possibility of buying and selling at that price, if so they wish.

As per water quality trading, the experience in North Carolina, for instance, shows where potential for improved design of the instrument may lie: by restricting trading to occur within zones, rather than having only one single zone.

In many of the cases (remarkably Chile and Australia), a crosscutting issue has to do with the fact that individual rational decisions (i.e. the trade should be beneficial both for buyer and seller) may paradoxically lead to inefficient (and unsustainable) outcomes (i.e. mutual benefit for trading parties at the expense of social welfare), unless environmental outcomes (including physical return flows) are duly factored in.

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