

Water rights, transactions costs and water policy reform

Stephen Beare and Anna Heaney
Australian Bureau of Agricultural and Resource Economics

Institutional issues in water resource allocation:
Lessons from Australia and implications for India workshop
Beechworth, 17–18 July 2003

While the reform of water access rights in the Murray Darling Basin has been given a high priority by both the Commonwealth and state governments, the progress of reform over the past decade has been slow. One impediment to the reform process has been the lack of a clear framework to identify the inherent problems with existing water property rights, and to put forward an operational vision of the required institutional reforms needed to reap the greatest return from the basin's water resources.

In this paper a framework is developed to evaluate existing water access rights in the Murray Darling Basin and to identify and prioritise changes to the institutional arrangements that govern these rights. Central to this approach is the role of explicit and implicit resource access rights, the role of externalities associated with water use and the recognition of transactions costs in establishing transferable access rights.

ABARE project 2874
ISSN 1447 3666



abareconomics

Introduction

Australia is a dry continent, and the Murray Darling Basin is characterised by variability in climate, particularly rainfall, with the consequence of highly ephemeral streams and rivers, and extreme fluctuations in the volume of water available for consumptive and non-consumptive uses, both within and between years. The development of irrigated agriculture has been heavily reliant on the harvesting of surface and ground water resources, and the use of irrigation storages and delivery infrastructure to, at least partially, offset the unpredictability of the climate. As the need arose, access rights to water were developed in common law with early legislation focusing on municipal, domestic and stock water supply and drainage. Driven by drought and the need for investment in irrigation infrastructure to store and distribute water, legislation was introduced to allow control of water resources by the states.

More than 100 years on, there is still intense policy debate surrounding the legal and institutional frameworks that govern the management and use of water resources. The Commonwealth and states have made several attempts at reform that have had mixed outcomes, with individual states implementing reform packages in different ways and with differing rates of progress. The physical and economic environment in which water property rights are being introduced is complex. Irrigation affects the volume and quality of water available to downstream users and the riverine environment more generally. Introducing trade, for example, with poorly defined property rights may generate external costs or benefits to water users and the environment. The purpose in this paper is to consider key aspects of market based water reform and in particular, the role of water access and use rights and transactions costs.

Water access rights in the Murray Darling Basin

Water access rights often evolve in the face of resource use conflicts.¹ Early in the 20th century, New South Wales, Victoria and South Australia were embroiled in conflict regarding the Murray River with New South Wales and Victoria accused of impinging on South Australia's lucrative river trade. Through most of that century, institutional arrangements in the Murray Darling Basin supported the open exploitation of water resources to promote economic development. The volume of access rights was not capped and resource access issues were largely limited to the sharing of common water resources between states (Marsden 2002). The tie between land and water use was seen

¹ In the context of this paper, the term 'water access right' is used to describe a right to a volume or share of a total amount of water that can be extracted from a source such as a dam. After the total amount of water that can be extracted is determined, access rights are then allocated on some basis to potential individual users. Depending on the conditions of the specific system, these rights may be transferable to other users and/or bankable for future use.

as the key to sound public policy. Initially both public intervention and private enterprise played a part in the development of water resources, but eventually the development of storage and delivery infrastructure was funded by governments with the intent to expand agricultural production and to support the development of rural communities.

The River Murray Waters Agreement of 1914 still sets out the basic tenets of water policy within the Murray Darling Basin: access rights to water resources within a state's boundaries are fully vested with that state and; states agreed to identify and manage common water resources, through the auspices of a Commission (Clark 2003). Legislation and water management were still concentrated on consumptive demand and there was little need to develop the rights and responsibilities of individual water users within what was effectively an open access environment. Water access rights tended to take the form of a non-transferable annual entitlement, managed by individual states.

Over the past 25 years there has been a slow but significant shift in water management priorities in the Murray Darling Basin. It is now realised that many of basin's water resources are fully or over exploited and access rights need to be constrained, or in some cases reduced. Since the 1970s, there has been increasing concern regarding the impact of irrigation and land clearing on downstream water quality, with problems such as salinisation, nutrient run-off and sedimentation. Further, it was recognised that water resources were over allocated and that water may need to be diverted from consumptive uses such as agriculture to create flow regimes that better support the health of the Murray Darling Basin's aquatic and riverine ecosystems. Economic issues were also of concern with aging infrastructure needing replacement or refurbishment. These issues are still the central concerns of water policy reform today (Clark 2003).

Water storages and extractions for irrigation have had a significant impact on the volume and timing of flows. In recognition of the problems of over exploitation and the need to allocate water to meet environmental demands, the Council of Australian Governments adopted a strategy for the efficient and sustainable reform of the water industry in 1994. Initial responses were primarily through changes in the way states manage their water entitlement systems. In 1997, New South Wales, South Australia and Victoria agreed to cap all water diversions within the Murray Darling Basin to 1993-94 levels. These states later agreed to participate in a salinity credit scheme to ensure that reallocation of water within and between irrigation developments did not increase the level of salinity in the Murray River system.

Achieving a reasonable balance between economic, environmental and social outcomes is a complex task and there has been increasing acceptance that the administrative framework that has formed the basis for resolving water access and use conflicts in the

Murray Darling Basin has not been adequate. The view that access rights should be vested with individual water users and that markets should be allowed to resolve resource use conflicts has been accepted by both state and Commonwealth governments. Central to the pursuit of this objective, is the separation of water access rights from the land to allow trade. However, how this separation is achieved is critical to achieving a more efficient allocation of water resources.

For markets to promote efficient trade between alternative water uses, water access rights must clearly define the rights and responsibilities of individual water users. Ideally these access rights would allow individual water users full access to the benefits of water use and hold them accountable for all the costs imposed on other users and the environment. This would allow the full benefits and costs of transferring water between alternative uses to be accounted for through trade. However, as with most common resources, the definition, monitoring and enforcement costs of establishing individual access rights that account for the full benefits and costs of resource use can generate significant transactions costs. In some cases, these transactions costs will be greater than the benefits derived from trade. Alternatively, imperfect access rights that may lead to some forms of market failure may still generate a more efficient allocation of water resources than an administered allocation system.

From a public policy perspective, the objective of market based water reform is to establish a set of resource access rights that meet two criteria. First, these rights should facilitate the transfer of water between a wider range of alternative uses at lowest possible cost. The greater the prospective range of uses that water can be directed to, the greater can be the value of the resource. The second objective is that economic incentives to transfer water between alternative uses more fully reflect all the costs and benefits of that transfer. The remainder of this paper is used to examine the characteristics of water access rights that can effectively be used to promote market based water reform.

Functional water use rights

A functional water use right is the right to use a volume of water at a specific location and time for a specific function. In principle, a functional use right could be an entitlement granted by the state. To exercise a functional use right an individual or collective water user, such as the environment, may need access rights to a range of resources, including the right to capture and store water within a dam, the right to access watercourses, weirs and delivery channels as well as the right to make use of specific industrial and urban water management practices. The way in which these water access rights are bundled can be quite use specific. For example, irrigating summer versus winter crops will place different requirements on storage and delivery infrastructure.

On a regulated river system, users at different locations can incur different delivery or transmission losses. The use of different delivery systems on-farm can affect the volume and quality of return flows to a river system. In the absence of transactions costs, the most efficient allocation of water resources would be achieved if each of these individual access rights were defined and traded separately in well functioning markets. The unbundling of individual elements of the resource right would allow separate decisions to be made on the use or conservation of each component. This is the central tenet of 'robust separation' of water entitlements proposed by Young and McColl (2002). However, when access rights are costly to define, monitor and enforce it may be more efficient to bundle these rights for the purpose of trade. Decisions to split the component rights should be dependent on the costs and benefits of that step for individual systems (Marsden 2002).

There is a degree of jointness in the resource access rights because the use right is location specific. That is, the value of any one access right can be completely or partially dependent on having acquired the remaining access rights required to secure delivery at a specific time for the specific function. The requirement to obtain a salinity credit to expand irrigated production is an example of a joint access right that effectively limits a functional water use right. From an individual irrigators' perspective, an access right to storage and delivery infrastructure will be of no value if he or she is unable to obtain access to a harvestable water resource. From a market perspective, if the volume of harvestable water resources is limiting water use, access rights to storage and delivery infrastructure will have no market value. So long as the availability of storage and delivery infrastructure does not constrain the level and efficiency of water use, there is no need to define separate access rights to these resources. However, if access to infrastructure is at times a binding constraint on water use, failure to define separate access rights will create a market failure that will impinge on the allocative efficiency of all other access rights, whether they are determined administratively or in the marketplace. Again, the cost of this market failure must be weighed against the transactions costs associated with establishing, monitoring and enforcing an appropriate resource access right.

It may, for example, be economically efficient to bundle water access rights into functional use rights and allow trade within an irrigation district if the functional use rights of water users within the district are quite similar. The collective costs of managing access to storage and delivery infrastructure, accounting for transmission losses and accounting for downstream impacts may be substantially lower than if left to individual irrigators. However, trade in functional use rights between districts may not be efficient given the differences in delivery losses and the impacts of irrigation on the

environment. An important point is that a uniform set of tradable water access rights is not likely to promote efficient trade in or between all locations.² From an operational perspective, the central problems in establishing tradable water rights are determining which access rights are necessary to define and establish institutional arrangements to promote trade, and those that should be left unstated or tied to other resource access rights. In other words, which property rights should be made explicit and which should be implicit.

Explicit rights versus implicit rights

Access rights to water resources are defined both explicitly and implicitly. With explicit rights, access to water resources is prohibited unless a user is granted a legal entitlement to a share or volume of an available resource and any associated storage and delivery infrastructure. Examples of explicit rights include licences to divert water from a watercourse or pump from a groundwater aquifer and entitlements to harvest and store water in a dam situated on a watercourse, as well as release it from the dam.

Explicit rights to an asset, such as a share in a dam, delivery infrastructure or a volume of available water resources that may be harvested at a particular location are relatively easy to define and exchange as the spatial and temporal characteristics of the resource are fixed. While the quantity of water available may vary with future seasonal conditions, a share of that resource has an expected yield and variance that is independent of seasonal conditions. The value of delivery infrastructure may vary substantially between periods of peak and off-peak demand, but this variation can be fully accounted for when considering an investment in, or purchase of delivery infrastructure assets.

Establishing the required well defined access or ownership rights to the assets that comprise basin's harvestable water resources and infrastructure is the first stage and the initial priority of market based water reform. It will provide a more secure basis for making investment that will generate the greatest return from these assets. Trade in water assets will not lead to a more efficient reallocation of water resources without the provision of services required to support the physical water market. These services are primarily storage to meet expected future demands and the transfer of water between storages and the site at which the water will be used or provide an environmental benefit such as a dilution flow. These services could also be designed to maintain or improve water quality. A well defined access right to water resources can lead to the

² The term efficient trade is used to imply trade that generates a higher degree of overall allocative efficiency.

development of markets to provide these services to the greatest number of potential users at the lowest cost.

While progress toward establishing better access rights to harvestable water resources has been limited, with the privatisation of irrigation authorities and trusts, irrigators now have greater control over the services provided and have responsibility for the costs of maintaining or expanding existing infrastructure. Extending private property rights to cover major storage and delivery assets that provide water to irrigation districts does present problems. First, these assets are a part of the natural river system and their use to harvest, store and deliver water has had a significant impact on the environment. Second, these assets form a natural monopoly that could be exploited for private interest and lower the return to water users as a whole and Australian society. However, these problems are not unique to water and can be addressed through an appropriate regulatory framework. The issue is, again, whether the benefits of privatising access to these assets is greater than the costs of regulating their use.

Not all explicit access rights to water resources are fully tradable. There may be physical constraints on trade between, for example, surface or groundwater resources that are not connected. Again, transaction costs can also be prohibitive. Consider a group of water users who hold licences to pump a volume of water from the adjacent river. If the current level of water availability is not sufficient to meet the licensed volume that can be extracted due, for example to dry seasonal conditions, it may not be possible to trade a licensed volume held upstream to a downstream user. This is because any licence holder between the source and destination of a trade can extract the additional flows. The upstream user cannot guarantee that the volume of water he or she is willing to surrender will be available to the purchaser. This would not present a problem if licences were defined in terms of a share of available flows. However, the cost of measuring available flows at every point along the river is likely to be prohibitive. The inability to effectively measure flows and transmission losses is a major impediment to defining efficient tradable water access rights.

An explicit access right may also convey obligations or conditions on water use. For example, in New South Wales property owners have the right to harvest up to 10 per cent of the rainfall on their property in on-farm storage. Conditions of access and use can be site specific and often site dependent. Using the example of harvesting water in on-farm storages, the volume of water harvested is depend on the level of rainfall that will vary with the location of the dam. Further, an irrigator may face restrictions on the way in which irrigation water is applied or ensure that return flows to watercourses meet quality standards. Alternatively, an irrigator may be required to hold a permit to discharge irrigation drainage that is saline or contains nutrients.

Regulations covering site-specific conditions of use are often costly to monitor and enforce. Ideally, a discharge permit required for irrigation drainage water should depend on the level of salinity and nutrients in the discharge, which would require the separation of the permit into its component levels of individual pollutants. In turn, the concentration of these pollutants in the drainage water would have to be monitored. Failure to establish site dependent conditions of use may lead to an inefficient allocation of resources. Those individuals with drainage that has, for example, a low level of salinity will be disadvantaged relative to those with highly saline discharge. However, the costs of implementing a permit system for individual pollutants may be greater than the cost of this distortion.

Nevertheless, it is still possible to construct instruments that allow trade, for example, tradable discharge or pollution through the use of permits. Further, if the benefits of monitoring and enforcing conditions of use exceed costs, the additional costs of introducing a tradable instrument have to be compared with the additional benefits that trade would deliver, taking into account transaction costs. However, trade can exacerbate or create distortions introduced by regulations governing conditions of use. For example, imposing a constant restriction on farm harvesting, across all farms is distortionary as it fails to take into account the value of the water used at a particular site, or the value of additional overland flows generated from that site. Trade in volumetric harvest limits could potentially lower the cost of sourcing the overland flows generated by the restriction on the use of farm dams. However, trade in the existing percentage-based limit could potentially create an incentive for users in higher rainfall areas to purchase harvest rights, lowering the overall level of overland flows. Trade in a percentage-based restriction could allow an individual to capture the resource rents associated with a larger capacity to harvest water resources. Simply making a water access right explicit, well defined and tradable does not imply that it will lead to an improved allocation of water resources. The right must also provide the right incentives for trade.

Implicit rights

Implicit water rights can be generated from two sources. The first is when access to water resources and infrastructure are simply not restricted. Implicit access rights include the right to increase the harvest of water on-farm through changes in land cover through, for example, planting trees or adopting minimum tillage cultivation practices. Irrigators also have an implicit right to select the crops they grow and the methods by which irrigation water is applied. Many irrigators have an implicit right to allow irrigation water to drain into water tables that contribute to salinisation and water logging.

However, as with limits on the harvesting of water in on-farm storages, regulations are in place or have been proposed to limit these implicit rights. In New South Wales irrigators can only grow rice on suitable soil types and are constrained by maximum irrigation water application rates. In South Australia, irrigators are required to meet water use efficiency targets as a condition on their water license that will effectively limit their choice of application methods.

The second source is when implicit rights are bundled with an explicit right. For example, on regulated systems in the basin, irrigators' allocations are defined at the point of final delivery rather than the point of harvest. This effectively grants irrigators one, an on-demand access right to storage and delivery infrastructure and two, an implicit right to water lost on delivery through channel seepage and evaporation.

Implicit rights that are bundled with explicit rights may be transferable, but as in the case of a functional water use right, the transfer of implicit property rights may not be economically efficient. Addressing these problems requires institutional arrangements that transform an implicit right into an explicit right. There are two major impediments to this process. First, the redefinition and redistribution of property rights always has the potential to have an impact on the wealth of individuals, creating both winners and losers. Second, implicit rights are often difficult to measure and hence costly to define. The right to increase the harvest of water on-farm through changes in land cover is a good example of an implicit right that would be difficult to transfer into a well defined volume or share of available water resources. The right to water lost through channel seepage is an example of an implicit right that could be transferred relatively easily into an explicit right with better water measurement and accountancy.

Concluding comments

In the basin, there are well defined and functional water use rights that allow individuals to acquire and use water at specific locations, times and for a specific purpose. The problem is that the allocation of these rights is not seen to be economically efficient from the perspective of Australian society in terms of both productive uses and environmental impacts. The reallocation of these rights through market based water reforms will impose transactions costs so the benefits of any reallocation must exceed these transaction costs if water reform is going to benefit Australian society as a whole. Further, if water access rights are not properly defined, trade may not deliver the intended improvement in the allocation of water resources. There is no common approach to defining access rights that will lead to the greatest increased return to water resources. In some instances volumetric rights are the best alternative, in other instances a resource share will provide the best approach.

Providing secure access to water where there are no arbitrary restrictions on trade has the potential to significantly increase the value of water use. The willingness to invest in infrastructure with high capital costs, such as viticulture, for higher value activities or more efficient application technologies will depend on expectations of what water access rights represent over time. These expectations need not be perfect; for example, irrigators would be expected to bear the risk of climatic variability. Further, secure access rights will provide the incentive to cost effectively establish the services needed to develop an efficient physical market for water trade.

Access to delivery infrastructure is particularly important during times of peak demand when capacity constraints are reached. Mechanisms may be needed to allocate delivery capacity to highest value users during peak demand periods. One mechanism would be to allocate infrastructure access rights and make them tradable where irrigators in higher value activities would be able to obtain delivery capacity by compensating irrigators of lower value activities. Again, the transactions costs of implementing such a mechanism would need to be outweighed by the benefits it would generate.

However, it is also important to recognise that the physical market may need to be underpinned by a range of institutional arrangements. These include improved water accounting so that access rights can adequately account for transmission losses and ensure that users bear the cost of those losses. These may also include the imposition of conditions on use to limit the impact of water extractions, storage, delivery and use on the environment and other water users.

References

- Clark S.D. 2003. 'Divided power, co-operative solutions?', in *Uncharted Waters*, Daniel Connell (ed). Murray-Darling Commission, Canberra, pp.9-21.
- Marsden, J. 2002. 'Water entitlements & property rights' paper presented to the 4th *Australasian Water Law and Policy Conference*, Sydney, 24-25 October 2002.
- Young, M.D. and McColl, J.C. 2002. *Robust separation: A search for a generic framework to simplify registration and trading of interests in natural resources*. CSIRO Land and Water, September 2002.