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Water rights: a comparison of the impacts of urban and irrigation reforms in Australia

Lin Crase and Brian Dollery[†]

Although there has been a policy thrust towards making all Australians more cognisant of the relative scarcity of water resources, the approach adopted for urban dwellers differs markedly from that applied to irrigators. These differences are examined from a property-rights perspective focussing primarily on the institutional hierarchies in the Victorian water sector. The analysis reveals significant attenuation of urban dwellers' rights, presumably on the basis of the information deficiencies that circumscribe urban water use. Alternative policy options are then proposed, which might alleviate some of these information deficiencies and simultaneously address the efficiency losses that attend the present arrangements.

Key words: consumer demand, institutional economics, water management and policy.

1. Introduction

Australia's urban water users are being asked to modify their behaviour to take greater account of the relative scarcity of the resource (see, for instance, DSE 2004). At the policy level, the tenor of the recently announced National Water Initiative (NWI) and the accompanying state responses have brought the water-related activities of urban communities sharply into focus. It might be argued that the heightened attention currently given to the behaviour of urban users is disproportionate to the extent of their extractive use. Nevertheless, given the powerful political influence of urban voters and the apparent determination of governments to see that the costs of any redistribution away from historical allocations is shared across all sectors (see, for instance, Anderson 2005; Bracks in DSE 2004, p. 5), the behaviour of urban water users is likely to attract continued scrutiny in the medium term.

Policy-makers have responded to the challenge of altering the demand for urban water in two ways. First, there has been a predilection to impose sanctions and restrictions on those activities deemed to be 'wasteful'. For instance, in Victoria, by-laws have been enacted to prevent hosing of hard surfaces, watering gardens in the middle of the day and hosing vehicles without trigger nozzles. Similarly, in New South Wales the BASIX regime has imposed mandated water savings in new housing construction. The second policy thrust has sought to alter urban behaviour by offering subsidies for purchasing water-saving devices.

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Perhaps not surprisingly, the reluctance of policy-makers to employ conventional price and trade mechanisms to adjust urban behaviour has attracted criticism. Edwards (2005) observed that the prohibition on particular water-use activities in urban environments challenges the efficiency criterion with which economists are familiar. Similarly, Crase and Dollery (2005) have raised concerns about the differing policy perspectives employed to encourage reform in urban versus irrigation contexts. These apparent inconsistencies raise serious questions about the overall efficacy of water policy.

To better understand the incongruously different policy approaches to urban water users and irrigators, the contrasting property rights regimes in each sector are explored. By doing so we hope to expose the source of potential deficiencies in the current arrangements, particularly in the urban water sector, and identify alternative policy approaches that deserve serious investigation.

This paper is organised into five main parts. In Section 2 the elements of water property rights are considered and the notion of attenuation expanded to deal with a range of property-right characteristics. Section 3 explores the notion of institutional hierarchies or 'nested' institutions (Ostrom 1990, pp. 50–51). Both of these concepts are used to consider the extant property rights in urban and irrigation settings in Australia in Section 4. This section also briefly considers the information and policy implications of this comparison. Possible policy alternatives to improve the flow of information to urban water users are also addressed here. Some brief concluding remarks are then offered in Section 5.

2. Property-right characteristics

A useful framework for considering property rights involves conceptualising them as a collection of entitlements over a resource rather than 'ownership of property' per se. In this context, a property right is more concerned with the relationships among individuals than with the relationship between individuals and objects of value (Bromley 1989, pp. 202–203). Put differently, property rights are more about the rights of individuals to impose restriction on the behaviour of others than they are about the 'ownership' of a resource.

A number of different definitions of property rights have been proposed in the literature (see, for example, Schlager and Ostrom 1992; Ostrom 2000). In this instance, we follow the diagrammatic representation developed by Scott (1989) that was later employed by Challen (2000, pp. 71–73) to depict the property rights of various irrigators in Australia. The framework developed by Scott (1989) describes property rights in six main dimensions. First, exclusivity describes the extent to which others can be prevented from accessing the item/resource or enjoying the benefits that flow from it. Second, duration is used to represent the period of the rights. Third, the ease with which a right may be passed to others is encapsulated in the transferability dimension. Fourth, divisibility endeavours to depict the degree to which the right can be subdivided. Fifth, the extent to which the right permits an alteration to the pattern of use is defined as flexibility. Finally, the quality of title

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attribute encompasses the capacity of the title to adequately describe the resource or item, enumerate penalties for violation, and specify the rights and duties of right-holders and others.

If we conceptualise rights as the 'power over the behaviour of others', non-attenuation implies that the discretionary behaviour of the right-holder is near absolute. For example, non-attenuated 'flexibility' of a water right would imply that the right-holder can alter the pattern of usage without regard to the impacts on others. Placing attenuation on the 'flexibility' of rights might limit the extent to which right-holders can modify usage.

Urban water use has been significantly attenuated by the various water by-laws and bureaucratic restraints on consumptive use in urban environments. Thus, one of the interesting conundrums in the context of urban water is the observation by Quiggin (1986, p. 106) that the attenuation of rights reduces the value to the owner and 'this is particularly true when attenuation is the result of actions by governments, such as regulatory limits on the way in which property may be used or restrictions on the sale and purchase of property.' The present policies stand in stark contrast to the stated goal of water reform in some states, which purportedly seeks to 'change the way we use and value water' (Bracks in DSE 2004, p. 5).

3. Institutional hierarchies and water rights

We observed earlier that property rights could be more appropriately defined in terms of their capacity to impinge on the behaviour of others: non-attenuated rights imply absolute discretion on the part of the right-holder to confine the behaviour of others in relation to the resource or item. Thus the reciprocity of rights becomes apparent. For instance, take the attenuation of the 'exclusivity' element of water which implies that others would have strong claims over the usage patterns adopted by right-holders. This might represent the present case for urban water users, who have relatively little flexibility by virtue of the regulations that prohibit particular consumptive uses. Prima facie, these arrangements might be considered to offer greater 'exclusivity' at the communal level, in the form of an urban water authority. In this situation, the individual household's exclusivity rights are severely attenuated while the group's rights (e.g. the water authority) become less attenuated.

However, the rights of an urban water authority cannot be considered without reference to the property rights of the state as a superordinate institution with potentially stronger claims. For example, the state can just as easily amend the rights of an urban water authority by imposing compulsory state-wide water saving targets. The point is that little headway can be made by considering the rights assigned at a single level. It is more instructive to consider rights as hierarchies where a single resource has multiple right-holders and attenuation varies along each property right element at each level. Moreover, 'the hierarchy comprises a system of nested rules where each successive level is legally supported and maintained by the superordinate level' (Challen 2000, pp. 24–25). A

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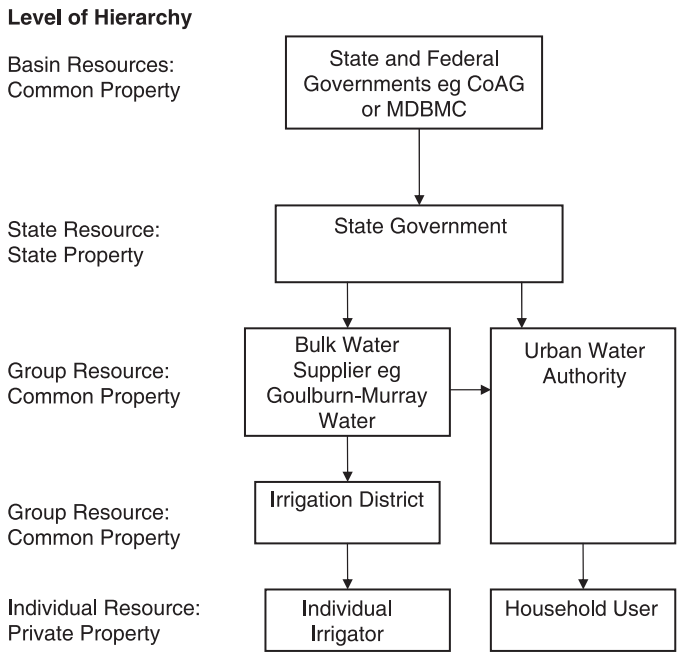

Figure 1 Institutional hierarchy for a set of urban and irrigation water users in Victoria. Source: Adapted from Challen (2000, p. 64).

simplified conceptualisation of an institutional hierarchy applying to a particular instance in urban and irrigation settings is depicted in Figure 1.

This is not the only hierarchical configuration possible and is most applicable in the case of Victorian water institutions. For instance, riparian irrigators may draw surface water directly from rivers and are therefore not subject to a superordinate institution, like an irrigation district.

If we accept this hierarchical conceptualisation of right-holders and recognise that there are interdependencies between the degree of attenuation at each level, an important question emerges: what is the appropriate amount of attenuation that should be applied at each level of the hierarchy? Put differently, what is the appropriate property rights regime at each level for urban and irrigation sectors?

According to Challen (2000, p. 28) 'the central issue in examining alternative institutional structures [which include property rights regimes] is that of transaction costs.' Although an extensive review of the published work on transaction costs is beyond the scope of this paper, suffice to say a relatively broad interpretation of the notion of transaction cost is employed here. In the current context they are taken to encompass the 'costs incurred in organising and coordinating human interaction' (Challen 2000, p. 28). Challen contends that property rights themselves emerge in an effort to curtail the transaction costs of exchange (2000, p. 29). However, costs are also incurred in the development of property right regimes and the enforcement thereof.

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Thus, when considering the efficient level of rights attenuation within a hierarchy, the problem reduces to discerning the property rights structure that embodies the lowest aggregate transaction costs. Put differently, '[t]he choice between alternative property-right regimes can be considered a problem of minimising transaction costs associated with the making of decisions over the use of resources' (Challen 2000, p. 31).

In addition to considering transaction costs in this way, it is important to understand the relationship between information and transaction costs. A body of published work has emerged from the concept of bounded rationality that seeks to precisely describe the information problems that form the foundation of behavioural uncertainty which, in turn, underpins the cost of organising and coordinating human behaviour, that is, transaction costs (see, for instance, Langlois 1984; Davidson 1991). In essence, this work indicates that the level of transaction costs is directly related to the imperfections attendant on a piece of information.

By way of illustration, consider the information that would be required to assess the value that urban users might place on different types of consumptive use and then distribute that resource in line with those preferences. In this case one of the advantages of a market framework with exclusive individual rights is that individuals are best equipped to rank their preferred activities and decide if benefits exceed costs. Moreover, to accomplish the same task at a higher level in the institutional hierarchy, say at the level of an urban water authority, would entail significant search costs on the part of the authority. Only when the information about users' preferences is perfect and cheaply available will the authority be able to replicate the low-transaction-cost outcome of individual choice in this context. Since omniscient water authorities are rare, the cost of undertaking this task at a level higher than the individual will nearly always be greater.

However, the corollary of this argument is that an urban water authority may have access to other information at lower cost than the individual. For instance, the authority may be better equipped to estimate future demand and the impact of current withdrawals on all other users over time. Thus, the attenuation of exclusivity rights for individuals might accord with lower transaction costs if the urban water authority is able to accurately encapsulate these wider issues at lower cost than is the individual. The upshot of this analysis is that the choice of one property rights regime over another can be reduced to a lower level of analysis than that which focuses on transaction costs. The question becomes one of the precision of information and the capacity to interpret and act on that information.

4. Comparing the property right characteristics of urban and irrigation hierarchies

As a way of operationalising the property rights hierarchical framework and the decompositional approach developed earlier, we return to the model

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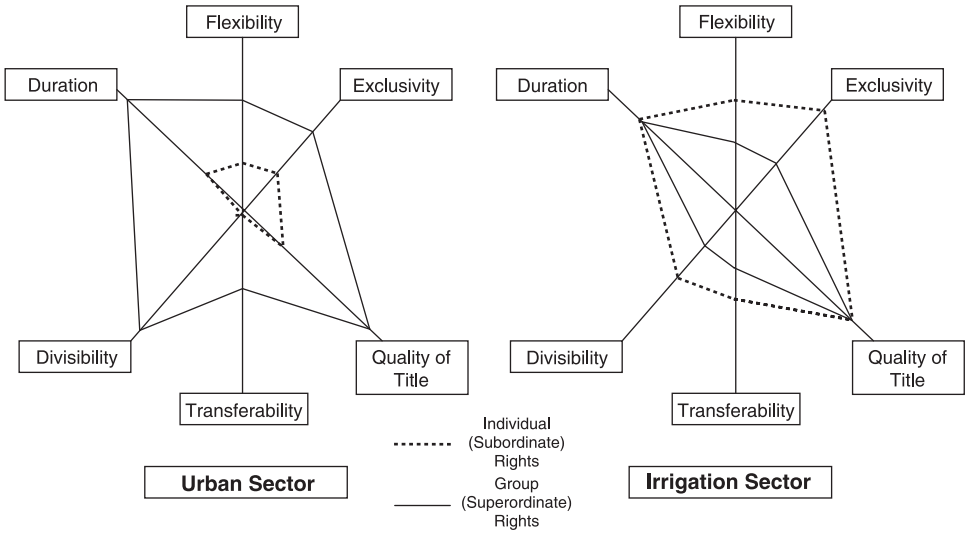

Figure 2 A comparison of property rights attributes across hierarchies in urban and irrigation sectors.

developed by Scott (1989), which diagrammatically unbundles rights into six main elements. The purpose of this exercise is to provide an overview of the extent of attenuation and distribution of rights to water resource users within the different sectors. To simplify analysis, the technique used here focuses primarily on the two lowest levels in the existing hierarchies in each sector. In addition, the analysis is reduced to focusing primarily on the institutional arrangements in Victoria, dealing only with irrigators who hold group entitlements (as defined by Challen 2000, pp. 72–71) and conventional urban households who purchase water directly from an urban authority. While no consistent metric is used to measure attenuation, points closer to the end of each axis symbolise less attenuation. A comparison of each of the sectors using Scott's framework (1989) is provided in Figure 2. For convenience, an explanation of the positioning of each attribute is summarised in Table 1.

Figure 2 and Table 1 provides an interesting contrast of the distribution and attenuation of various rights at the group and individual levels in urban and irrigation sectors. On every front, the rights of individual urban water users are attenuated relative to the rights enjoyed by the superordinate institution, i.e. the urban water authority. By contrast, the individual rights assigned to irrigators are less attenuated on most dimensions when compared to those ascribed to the group irrigation institution. As we saw, this state of affairs may be justified on the basis of transaction costs and the distribution of information at the various levels of the hierarchy in each sector. However, as we observed earlier the question of institutional efficiency centres on the effectiveness with which each level of the institutional hierarchy accesses and then acts upon that information.

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Table 1 An explanation of the level of attenuation of individual and group rights in irrigation and urban water use

Property rights attribute	Irrigation sector		Urban sector	
	Group	Individual	Group	Individual
Flexibility	Water resources can be redistributed to any use (subject to the constraints of historical supply commitments).	Choice of enterprise largely resides with the irrigator, although the group can influence some decision, like choice of irrigation technique.	Water resources can be redistributed to any use (subject to the constraints of historical supply commitments).	There is some scope to amend internal household use. Outdoor activities are heavily attenuated.
Exclusivity	Bulk entitlements are defined in terms of the quantity of available annual water although legislation can be enacted to take water for other uses without an obligation to offer group compensation (e.g. decommissioning Lake Mokoan).	Entitlements are defined in terms of the quantity of available annual water rather than being attenuated by the actions of other users. Compensation applies if water is taken within the duration of rights.	Bulk entitlements are defined in terms of the available annual water and are subject to the conditions of stream flow management plans and the like. Aspirational water saving targets are likely to be imposed by superordinate institutions.	Entitlements are subject to storage levels reaching 'triggers' which activate quantity restrictions. These are also subject to bureaucratic intervention and/or suasion.
Quality of Title	Rights and obligations specified by legislation, licence conditions and the like.	Rights and obligations specified by legislation, licence conditions and the like.	Rights and obligations specified by legislation, licence conditions and the like.	Rights and obligations are specified in customer charters. Redress available through VCAAT.
Transferability	Theoretically, it is possible for an irrigation group to transfer bulk entitlement to others. In practice this right is attenuated by the relative scarcity of water and the exclusivity of subordinates.	Individual entitlements can be transferred temporarily or permanently, subject to some attenuation by the group (e.g. proposed exit fees).	Urban water authorities can transfer water between sectors and locations. The proposed legislation limits non-irrigator participation in the water market to a maximum of 10 per cent of entitlement.	Households cannot transfer water to others.
Divisibility	As with transferability, this is theoretically possible but practically constrained by the rights assigned at the subordinate level.	Generally any portion can be transferred, although there may be some minimum transfer rules imposed.	Urban authorities can subdivide interconnected entitlements and move them to areas of greatest demand (within the limits of stream flow management plans and the like).	Households cannot divide their rights and transfer water to others.
Duration	Entitlements are subject to periodic review.	Entitlements are subject to periodic review.	Entitlements are subject to periodic review.	Access charges provide annual rights at best.

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To illustrate this point, we briefly return to considering the contentious imposition of 'smart water by-laws' enacted in Victoria, which prohibit particular urban activities by households. We have argued that these constraints represent an attenuation of the exclusivity attribute of property rights since they limit the flow of benefits arising from the resource. When considered in the context of the informational requirements at each level in the institutional hierarchy, these arrangements take on a different meaning. The attenuation of the individual's property rights on this dimension is presumably justified on the grounds that the information necessary for individuals to make an efficient allocation of the resource between different activities is inadequate.

However, there are two dimensions to this information deficiency that require closer scrutiny. The first is the presumption that individuals do not understand their own preferences. This argument is at odds with the expansive theoretical and empirical published work on preference formation. The second ground for attenuating the individual's rights is that the individual lacks sufficient information about the preferences of others and thereby chooses an inefficient allocation of the resource by not giving regard to the consequent impacts on others. Thus, the group's imposition of constraints on the property rights of the individual reflects the superior information available to the superordinate institution. The problem with this approach is that it assumes that the superordinate institution has an adequate grasp of the relationships between the water activities of different individuals and the overall management of the urban water supply. This remains largely an empirical question and has not been well explored. In addition, the evidence on the efficiency of bureaucratic intervention in this context is not particularly encouraging (see, for example, Crase and Dollery 2005; Edwards 2005).

The penchant for urban water managers to rely on quantity restrictions or rationing, and thereby attenuate the rights of households, can also be traced to fundamental philosophies that pervade urban water management. It is clear from the policy debate that policy-makers are convinced that urban water demand will continue to rise in line with population growth (see, for example, DSE 2004). A related strand of thinking is that urban water demand will remain relatively inelastic and, accompanied by the political costs of charging higher prices for 'water required for life', water rationing is the only alternative. However, there are serious flaws to both of these propositions. First, urban water scarcity in Australia is both a function of the distribution of rainfall relative to population and the historical allocation of the resource to other users. The former constraint is not easily reconciled or may require expensive engineering solutions; the latter is dependent on the resolve of policy-makers to encourage intersectoral trade. To date, the rhetoric of water policy that espouses 'moving the water to higher-value uses' has not been matched at the administrative and political levels where intervention continues to stall the transfer of the resource from irrigation to urban and industrial users. Put simply, rationing at the household level is, in part, a consequence of the constraints

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imposed on trade between irrigators and urban water authorities – water is scarce in urban contexts partly because it has proven difficult to transfer the resource from arguably lower-value users.

Second, the link between population growth and urban water demand is premised on modest or nil behavioural adjustment on the part of urban users as resource scarcity alters. Thus, the superordinate institution accesses and interprets information about water scarcity on behalf of individuals in order to deliver a more 'efficient' outcome. This approach belies the role that price plays in transmitting information to households for a range of other products and services. The use of price as a vehicle for transmitting information to individual urban water users has received insufficient attention from a policy perspective in Australia, and a consideration of the institutional arrangements for setting short- and long-term prices seems overdue.

Presently, most urban water authorities are subject to periodic pricing reviews by economic regulators. In Victoria, the Essential Services Commission reviews the price regime of each water authority, largely on the basis of the cost of service provision and anticipated capital expenditures to maintain or upgrade services. The relative scarcity of urban water is encapsulated into these prices in two forms. First, if an urban water authority is forced to purchase additional water access rights (assuming it can do so without physical constraints, political or administrative intervention), then these expenses will be incorporated into the cost base upon which future prices are established. Second, if additional water infrastructure is required to reduce 'waste' or facilitate harvesting 'new' supplies, then these costs will inflate the regulated price faced by households. These arrangements make no provision for communicating to households the immediate status of the water available in any storage. Thus, while price currently transmits some information about the long-term availability of the resource, albeit imperfectly because of constraints imposed on trade between sectors, this occurs at delayed intervals of 3 to 5 years. Moreover, price signals at the household level arrive only sporadically, in the form of quarterly or biennial water accounts, and often with substantial delays between the consumption activity and payment. Thus, in addition to the purported equity and political constraints of using price signals, these temporal deficiencies in the price mechanism have been used to sanction the quantity rationing adopted by superordinate urban water authorities.

However, in their enthusiasm for quantity rationing comprising the banning of perceived profligate water uses, at least two fundamental policy alternatives have been largely overlooked. First, little attention has been given to enhancing the price signals received by urban households. To date, most interest has centred on the level of water prices per se rather than the mechanisms by which prices might transmit information to users. By contrast, in the irrigation sector imaginative institutional arrangements that encourage price revelation through temporary and permanent water trade, and efforts to ensure that regulated bulk water prices reflect costs, have been lauded as

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major reform achievements. It seems a pity that similar endeavours on the policy and research fronts have not been applied to the urban water domain.

Using water storage levels as triggers to prompt short-term *price* adjustments offers an alternative to rationing that targets individual water use activities. For instance, seasonal scarcity of water could conceivably be communicated to households by establishing regulatory triggers at which water authorities could adjust price. Notwithstanding that this places the onus on regulators to garner additional information about the behaviour of households and the hydrological performance of water storages, the results would likely embody fewer efficiency losses than those that attend the status quo. However, fully flexible short-run marginal cost pricing may pose some problems, particularly if excessively high prices lead to undesirable reductions in some water use activities. Nevertheless, these problems might be more effectively dealt with through subsidies than by distorting the price of urban water.

The use of new technologies to provide timely price signals to household users has not attracted serious attention in the urban water sector. In the case of electricity, for example, some households can now closely monitor consumption and cost without resorting to burdensome journeys to dimly lit meters inhabited by spiders and other pests. In Sydney, *EnergyAustralia* has embarked on an experiment with 1300 customers where real-time information on electricity consumption, costs and greenhouse emissions is provided to households (Frew 2006, p. 1). No similar initiatives appear on the horizon for water.

The second policy area ignored in the urban context is the assignment of rights to individual urban users on a quantity basis that reflects the relative scarcity of the resource. Individual irrigators' rights are now defined as a proportion of water available for consumptive use and this is encapsulated in the 'exclusivity' dimension of rights. Irrigators thus share the risk associated with fluctuations in water availability. However, temporary and permanent trade can redistribute risk between irrigators. By contrast, in the urban sector most risks are borne at the superordinate level within the water authority. Historically, urban households expect that water authorities will deliver at least some minimum quantum of water on demand and these rights simultaneously accompanied physical connection to the urban water network. The risks that accompany increased urban demand or reduced water inflows to storages are then carried by the water authority (which usually manages those risks by quantity rationing during water shortages).

Notwithstanding that practices of this kind add complexity to designing marketable rights at the individual household level, the acceptability of household quantity-based rights has not been tested. Moreover, households may well prefer this form of 'rationing' to the current mechanisms that unilaterally impose the values of the policy-maker or water manager on the range of activities available to the individual households. A quantity-based urban system of rights would also provide more transparent comparisons with other sectors. Scrutiny of the preferences of urban water users should be

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a priority, particularly where urban and irrigation users are interconnected and where political and administrative constraints over intersectoral trade currently limit the capacity of urban water authorities to redistribute risks.

5. Concluding remarks

Water reform in Australia is attracting international interest and has been applauded by several observers. For instance, Saleth and Dinar (2004, p. 173) contend that '[t]hese [policy] changes further enhance the role of economic instruments and market-based water allocation procedures while also improving the physical health and sustainability of the water sector in Australia.' Similar acclaim appears in *The Economist* (2003, p. 13) where Australia was described as 'the country that takes top prize for sensible water management'. These comments relate primarily to reforms in agriculture – progress on urban water reform is unlikely to attract similar praise.

To illustrate these differences we decomposed the property rights of irrigators and urban water users and showed the importance of considering the hierarchy of institutions that influence decision-making in a particular sector. In addition, the analysis underlined the role of transaction costs and information deficiencies.

Applying this analysis to the urban and irrigation sectors in Australia provides a stark contrast between the different assumptions that would appear to be imposed by policy-makers. This analysis suggests that the broad acceptance of the current regulatory arrangements adopted in the urban sector deserve further scrutiny. In addition, a reconsideration of the potential role played by price and refining the institutional arrangements by which price communicates information about water scarcity would appear warranted. Alternative formulations of quantity controls also deserve consideration.

Several important challenges accompany these tasks. At a technical level, a more detailed understanding of urban water behaviour and its relationship to alternative policy choices requires investigation. At the political level, gaining acceptance for alternative policy approaches will always be problematic, particularly given the historical allocation of the resource. However, until completed, similar plaudits to those applied to irrigation reform cannot be applied to Australia's urban water policies.

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