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Principles and Issues for Effective Australian Water Markets

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Most of Australia experiences a scarcity of water. Allocating more water for irrigation, households, industry, recreation or for the environment means less water for other uses. As a result of history, and especially the strategy of allocation primarily on a first-come-first-served basis, much of the present water allocation pattern departs from the efficiency norm where marginal social benefits are equated across the different alternative uses of limited water. Further, future changes in relative market prices, incomes, technology and so forth will call for a continuous process of reallocation of limited water resources. There is a growing consensus, supported by direct government initiatives at the Commonwealth and State levels, for greater use of effective water markets to allocate scarce water.

This paper explores some of the principles and issues to further the development of effective water markets in Australia. In particular, it considers some of the details necessary to turn into practice the general ideas canvassed in recent Council of Australian Governments (COAG) statements (including those of 1994, 2002 and 2004) and the White Paper released by the Victorian Government (2004). Sections 1, by way of background and to provide a reference evaluation benchmark, briefly summarises the principles of allocative efficiency and where market forces of price coordination are likely to be effective. The present state of water market development, and recent government policy initiatives, are sketched in Section 2. The main part of the paper lists and evaluates some of the options on details of the operation of effective water markets. Section 3 considers the definition of water property rights for private good uses of water. Options for government intervention in the market to allocate water for environmental flows to provide public goods are considered in Section 4. Section 5 focuses on some of the implications of effective operating water markets, including questions of structural changes, efficiency and equity. Issues of prices, regulation and investment in the Victorian Government White Paper (Victorian Government, 2004), and to a lesser extent in the COAG statements

(COAG, 2002 and 2004), are reconsidered in Section 6. A final section provides some conclusions.

1. Ideal Allocation[1]

Efficiency in a static sense is achieved by allocating water from a given reservoir (dam, aquifer or river basin) between the different uses and users so that the marginal social benefit from each water use is equal. Different water uses or users could be different irrigators of a particular crop, different households along a street, or irrigators versus households versus the environment. In the end, individuals benefit from the different uses of water, including irrigation to produce food, running showers, and providing life to red gum forests and biodiversity to pass on to future generations. Investment to increase effective water supplies by, for example, new dams, piping, recycling and desalination would be efficient if the marginal social benefit of the extra water at least covered the marginal social cost of the investment. Subject to inter-reservoir linkage costs, different marginal social benefits will be found at a point in time across the different reservoirs, and different allocations and marginal social benefits will be found over time as circumstances evolve and change.

Competitive water markets using changes in the price of water to signal changes in scarcity achieve allocative efficiency where the water uses have private good properties of rival consumption and low costs of exclusion, and all social costs of water supply and consumption are also private costs. In these cases, marginal social benefits (and costs) also equal marginal private benefits (and costs). Then, the pursuit of personal well-being by individual firms and households will draw on all the available information to equate marginal private benefits, which also equal marginal social benefits, with the market price across the different uses and users of water. Most commercial uses of water by irrigators, industry and households have private good properties. If clearly defined and administered property rights are provided, a water market will efficiently allocate scarce water, and then reallocate it in response to changes in market circumstances.

In some cases the consumption of water, particularly the disposal of waste water, will involve external costs. In one sense these externalities can be said to reflect

incomplete property rights, that is, the costs of pollution are not included explicitly in the responsibilities of the water user. Alternative market failure correction measures for consideration include taxes (set at the marginal external cost), tradeable pollution permits (with the aggregate permit quantity to equate marginal external costs and marginal abatement costs), and regulations (to equate marginal pollution costs and marginal abatement costs).

Government intervention to increase the allocation of water to provide for environmental flows which generate public goods, which have the characteristics of non-rival consumption and high costs of exclusion, is likely if the marginal social benefits are to be equated across different uses of the water. Examples of public goods provided by water allocated to the environment are the existence and option values of biodiversity and heritage supplied for the current and future generations. As individuals in the cities and the country, we have to trade-off the opportunities of more water for, say, an extra 100 hectares of red gum forest versus, say, an extra five minute shower or more water for summer lettuce. Since public goods are characterised by non-rival consumption, the sum of individual marginal benefits gives the marginal social benefit. Ideally, this sum would be equated with the market price for water used for the commercial products to achieve an efficient allocation.

Almost certainly a mixture of a competitive water market and government intervention in response to market failures associated with pollution and with public good properties of some environmental uses of water will be required to achieve a close to efficient allocation of scarce water resources.

2. History and Recent Policy Initiatives

Up to around 1970 the methods of water allocation in Australia were primitive by economic standards and the principles enunciated above. Typically water was a part of the land right, available water was allocated on a first-come-first-served basis, and the charge or marginal cost to users was close to zero. To an important extent, demand was met by government funded increases in investment which often was motivated more by political motives than by a formal benefit cost assessment. During droughts a variety of quantitative regulations were used to ration supplies. These

allocation procedures applied for city and country, and for surface and underground water.

Around 1970 many urban and rural areas of Australia entered into the so called mature water economy stage where demand by commercial users at close to zero prices exceeded the available supply on average. Competition between farmers for limited water, and to a lesser extent between irrigators and other users, was accompanied by perceptions, and then later by formal analysis, that some potential new users placed higher marginal values on water than did existing users[2]. There also was a growing awareness that the health of some rivers, however defined, was being placed at risk, together with increased political support and pressure to maintain flows, if not to increase water, allocated for environmental flows. These changing circumstances have contributed to significant policy moves from the 1990s to the present.

A major policy switch point was the 1994 statement from COAG (COAG, 1994). It was proposed that the ownership of land and water be separated, that trade in water from low value to higher value uses be encouraged, that the need to allocate some water for environmental flows be recognised, and that prices be set for water to at least cover operating costs of delivery. These reforms were overseen by the NCC. Water trading developed, more so for temporary trades within regions. Trade across years and regions has been less important, in part because of greater uncertainty about property rights for trade over time and across regions and partly because of the restrictions and other transaction costs. In some rivers and underground aquifers, caps were placed on water which could be withdrawn for commercial use to protect environmental flows.

COAG has pushed the reform story further over 2002 and 2004 (COAG, 2002 and 2004). It has proposed that farmers be given secure water rights, not unlike land rights. These rights include a schedule to claw back over-allocations, and a formula for sharing the risks if forthcoming scientific analysis suggests the need for a further claw back. Many operational details about the water rights and about operation of the water market remain to be resolved. Increased flows for environmental purposes are to be met partly by the claw back, partly by Commonwealth and State government

funded investment projects, and with the right to purchase water at market prices from the commercial water market. So far the policy discussion has been more about the magnitudes of flows for the environment than about the type of flows, the gains in environmental outcomes, and nothing about society's values on the enhanced environmental outcomes relative to the opportunity cost of commercial use values of water. These and other reforms are to be overseen by a newly created National Water Commission.

The Green and White Papers produced by the Victorian Government in 2003 and 2004 (Victorian Government, 2003 and 2004) have complemented the COAG policy initiatives, and in several areas they have filled in some of the details for Victoria. For irrigators, it is proposed that there be an unbundling or a separation of the system for irrigation with water rights, and then two types of water rights (namely high security water rights and lower security rights for formerly "sales" water reduced by 20% for environmental flows) which are legally recognised and independently tradable rights, a water delivery right closely tied to land, and a use licence tied to land (but maybe also to crops and irrigation methods) to reflect relative pollution costs which might be addressed by regulations, taxes or tradeable permits. Grandfather arrangements give the water and delivery rights to existing irrigators. A 15 year review system is proposed to transparently review water rights in the event of climate change and other external changes affecting the availability of water. To a large extent the urban water market, and in particular Melbourne, has been isolated from competing against irrigation users (not just north of the divide but also south of the divide). In addition, for Melbourne there are to be no more dams, with the water demands of population growth to be catered for by restrictions on demand which are to be achieved by a combination of education and awareness, pricing of water, regulations on usage, rebates for water saving technology, water sensitive urban development, and recycling for non-household uses. No allocative arguments are given for the balkanistion of urban water from rural water. A number of State funded investment projects are flagged to increase the available water to meet target environment flows.

3. Water Property Rights

For markets to be effective in allocating outputs and inputs, including water, from low value uses to higher value uses a pre-condition is a well defined system of property

rights for the product being bought and sold. This means that the characteristics of the product are clearly defined and generally understood and measurable, that the benefits and costs of the product are captured in the property right, that property rights can be freely traded, and that these conditions have a legal basis which is effectively administered. In developing effective water markets in Australia, good property rights raise questions about the system design, the product characteristics, the accounting or recording system, and the initial allocation of water property rights.

The use of water involves at least the three stages of the initial water product in a dam or aquifer, delivery of the water to the user, and use of the water including waste disposal. For many different potential users and uses of water the delivery and use stages involve very different activities which incur different costs. For example, delivery costs vary with proximity to the prime water source, the evaporation and seepage losses during transit, competing opportunity costs where capacity is limited, and with the required water quality. Water usage can result in different pollution costs associated with the different types and toxicity of wastes, soil type, irrigation method, and so forth. Given the different costs associated with different users and uses of water which need to be included in social costs to allow a market to efficiently allocate limited water, at least in a transaction cost free world these different costs need to be recognised as characteristics of water property rights. One way to approach this multiple characteristics issue is the White Paper (Victorian Government, 2004) model to unbundle the issues by establishing separate property rights for the primary water product, essentially at the dam or aquifer, a delivery right, and a use licence which seeks to internalise pollution costs associated with wastes. This then leaves a thick market for a homogeneous water product at the dam wall or in the aquifer. Water use then would require holding a water entitlement, a delivery right and a use licence, which collectively involve prices or costs reflecting the social marginal opportunity cost of water to each user and use.

There are a number of options in specifying the water property right, especially in recognition of the natural volatility of rainfall across seasons and perhaps in a trend sense over time with climate change. The simplest measure is to specify a single water entitlement as a share either of water released from the primary supply, or as a share of the net inflow. Another strategy is to specify one entitlement in volumetric

terms with a high probability of availability, a high security entitlement, and then a second lower security entitlement for a share of the residual supply. Where different users have different preferences regarding security of supply, for example household demands for drinking water versus for garden watering, and the irrigation of perennial crops versus annual crops, I have argued elsewhere (Freebairn, 2004) for the two entitlement model over the singe share product, and this model is proposed in the White Paper. There has been some discussion about whether the water entitlement should be for a gross water diversion or for a net diversion (adding back returned quality water) (for example, Young and McColl, 2003). In principle net use is the appropriate measure, but it raises measurement costs for the quantity and quality of return flow water, which may result for practical reasons in the choice of gross flows as a second best solution. Given the seasonality of water catchment for most dams in Australia, a water entitlement per year seems the appropriate time interval.

Because most uses of water require complementary investments with effective lives of many years, and often decades, water entitlements with long lives are sought to provide confidence in making these investment decisions. Current arrangements have been unsatisfactory because of uncertainty about future water entitlements. Both COAG (COAG, 2004) and the White Paper (Victorian Government, 2004) have proposed entitlements with perpetuity characteristics, but with qualifications. COAG has flagged a schedule for adjusting water rights downwards in the event of new scientific information, and climate change, reducing the available water for consumptive uses. The White Paper discusses a revolving 15 year review process. Clearly different options affect the allocation of risk between entitlement holders and government. However, so long as future adjustments are explicit and believed, property rights remain clear and markets can work.

Water losses due to evaporation and seepage in the process of delivery to different points may be handled in at least one of two ways[3]. One way is for the effective water rights to be specified with a discount factor to reflect losses from the dam wall to the delivery point. Another option is to include the losses in the operating cost of the delivery charge price. Losses are likely also to vary with seasonal conditions which may justify a further fine tunning of the property right definition.

Issues concerned with the description, pricing and operation of water delivery rights are not fully developed. In several cases, sometimes for particular regions and more so for particular times of the year, capacity constraints are being reached with the existing water delivery infrastructure. For these periods, the property right should be specified for relatively short time intervals, perhaps as short as a day, with market bidding and associated scarcity prices to allocate limited delivery capacity.

At a minimum, the delivery right should include a charge for variable costs, usually defined by governments as operating costs and the annuity value of new investment (and major refurbishment) extensions. The White Paper proposes also that urban customers pay for historical capital costs, but that rural customers only pay operating costs; with political and equity supporting arguments. From an economic perspective, past capital costs are sunk costs, but, if the water entitlement is to include a scarcity rent, as it will, it is arguable that some of this rent could be skimmed off to meet past investment costs.

A contentious area with delivery rights is the issue of stranded water delivery assets. The problem situation of concern is one where the operating costs are largely of a fixed nature (at least for quantities up to capacity), and some but not all users of a particular infrastructure unit sell their water. As a result, the remaining users are faced with a higher share of the operating costs. The White Paper (Victorian Government, 2004) proposes that water delivery property rights be specified so that all existing users (in a type of grandfather arrangement) be required to meet their share of the operating cost regardless of whether they use the delivery infrastructure or not, primarily on the argument that the water delivery infrastructure provides a valuable option which is capitalised in a higher property value. This property right specification seems to provide for efficient decisions on the transfer of water, and assuming small group negotiating works it also can result in efficient decisions on infrastructure investment and closure.

Almost always the water delivery infrastructure will have natural monopoly characteristics. To avoid monopolistic exploitation and inefficiency requires government intervention, either by direct ownership and setting prices at marginal cost or by regulation by price ceilings on private firm suppliers. The White Paper

(Victorian Government. 2004) proposed that the Essential Services Commission provide this monitoring/regulatory role.

Many of the uses of water involve pollution costs, such as sewage and industrial waste, and irrigation run-off into the water table, and these costs are important components of social costs of the use of water. Further, the magnitude of the costs of pollution per unit of water use vary widely, and there are a number of operating and investment options which can ameliorate the magnitude of external costs. Water use licences provide one way to internalise the pollution costs. The licence could take the form of regulation, for example requirements to treat sewage and blocking the transfer of irrigation water from low-impact to high-impact regions, or of taxes on the externality, for example a tax per ML of sewage or per Ml of irrigation of rice in region X, or the requirement to purchase an emissions permit, for example on sewage into a river or salt emission. In some cases the pollution is of point form, and measurement is relatively easy and low cost, for example most household and industrial waste water. By contrast, much of irrigation related water pollution, for example seepage into underground water tables and salinity damage, is of a non-point and difficult to measure form. Here recourse may be required to the measurable inputs, outputs or production methods which are only imperfectly related to the pollution externality. Sometimes the second best solution may be worse than allowing the externality.

Effective water markets will require a registry of information on the ownership and transfers of water entitlements, delivery rights and use licences which is transparent and available to all at minimal cost and which has the full backing of the law. Suggested options include a public operated system similar to that which applies to land titles, or a share system as now applies to the ownership of rights in public companies and is administered by a regulated private organisation. Electronic markets would bring buyers and sellers together to negotiate mutually beneficial transfers and prices. Again, information on transfer prices and quantities would be readily available to the public.

The initial allocation of property rights (for water and for delivery) is a contentious political issue. The Coase theorem (Coase, 1960) shows that a competitive market

will reallocate well defined property rights to achieve an efficient allocation regardless of the initial pattern of rights allocation, but clearly the initial allocation will affect the distribution of wealth. To a large extent water and delivery rights in Australia have been allocated as a joint input with land on a first-come-first-served basis, but there have been some market transfers in recent years. At the same time, the legal basis of water rights ownership has been unclear (for example, Godden, 2003). Both COAG (COAG, 2004) and the White Paper (Victorian Government, 2004) have proposed an initial allocation of perpetual leases to water, and in the case of the White Paper also to delivery infrastructure, to existing users in a type of grandfather arrangement, but with a right of ultimate government ownership and with payment to current holders on just terms. This allocation strategy has the advantage of preserving a perceived status quo distribution of wealth without compromising an arrangement of future market reallocations to shift water from low value to higher value uses. Where additional water becomes available, or for those few cases where the view is that surplus water is available, additional rights would be auctioned to the highest bidders with the scarcity rent accruing to the State.

A contentious area in the initial allocation of water rights has been the case of offering the new water entitlements to current holders of so called "sleeper" and "dozer" rights. These are cases where the land had a water right, but the right to use water had not been exercised, or only infrequently, in recent years. Some of these holders claim the sleeper and dozer rights have had insurance value, although non-use suggests the marginal value was relatively low. Clearly, offering the ability to separate land and water into distinct property rights has provided new market opportunities and additional wealth for the holders of sleeper and dozer rights. At the same time, sale of the largely unused rights to active water users augments the use of water in many already stressed river systems. Unfortunately, in many river systems it is too late to avoid the validation of sleeper and dozer licences since they have already being sold, at least in temporary water sales.

There is a compelling case to issue explicit and formal water entitlements for upstream (or above dam) users as well as for downstream (or below dam) users, and again to grandfather the present allocation. For example, whether water should be used upstream for additional forests or expanded farm dams, or whether it should be

used downstream for irrigation of cotton or for urban consumption on green lawns is part of the general water allocation problem. Markets would provide the coordinating mechanism for sorting out who values the water more highly.

4. Environmental Flows

Everywhere the Australian water allocation debate is coloured with calls for more water to be allocated to environmental flows[5]. It is important to recognise that in a mature water economy, additional water allocated to environmental flows has opportunity costs of less water for irrigation, industry and households. At the same time, it is important that the choices between the different uses recognise that the ultimate benefits of additional water allocated to the environment come in the form of enhanced survival of biodiversity, heritage, recreation and other products valued by households when compared with food, showers, green lawns, housing and other consumer products. The present allocation and flows, including the effects of already-built dams and channels and the near reversal of seasonal flows is the starting point from which changed allocations have to be assessed. Ideally, water should be reallocated to (or from) environmental flows so that the marginal social benefit of the change in biodiversity, heritage, recreation and other products made possible with the extra allocation equals the marginal social value of the marginal water allocated away from irrigated food production, a shower, a green lawn and so forth.

Clearly many challenges have to be surmounted in obtaining estimates of the marginal social benefits of water allocated to environmental flows. Nevertheless, the general strategy is well known. First, information is required on the changes to biodiversity, heritage, recreation and the other products provided by extra water for the environment. An important sub-question here is the form and timing of the environmental flows, with the extreme examples of mimicking the seasonality and volatility of pristine flows versus a regular and constant flow per week. Second, household valuations of the marginal benefits of changes in the biodiversity, heritage and recreation products are required. Contingent valuation and choice modelling techniques, while contentious, are available for this purpose. Given the non-rival property of most of the household benefits of greater environmental flows, the sum of individual benefits across the members of society will be required to reach a measure of the marginal social benefit. Third, the derived marginal social benefit of extra

products provided by the extra environmental flows would be compared with the market price of water traded between irrigators, industry and households.

Several options for the actual administration of the allocation of water to the environment might be considered. The water allocation for the environment could be specified as a minimum share of supply, or as a minimum volume, or water entitlements of comparable attributes to those given to commercial water users could be provided to an environmental manager. The objectives, operating institution and procedures, and monitoring and reporting requirements for the chosen environmental manager would need to be explicit and transparent.

5. Operation of Effective Water Markets

To a particular household, business, irrigator, environmental manager and other water user, the cost of water at the point of water use would reflect three components. These are the scarcity value of water, delivery costs, and costs associated with the use licence. Use licence costs primarily reflect the external or pollution costs of waste water disposal, for example sewage treatment and remaining pollution costs to third parties, or costs of water table and salt additions in the case of irrigation. They might be in the form of taxes and charges, or the market price of tradeable permits, or the cost of complying with regulations. Delivery costs include the operating costs of water treatment and delivery plus any scarcity rents set by the market for allocating limited delivery capacity. The market price of water entitlements essentially would be a scarcity rent representing the opportunity value of water in its next most valuable use.

Several water entitlement product prices would co-exist. A price for water flows over a short time interval of a season or year for temporary transfers would be relatively volatile, and in particular it would respond to variations in rainfall. An asset stock price would reflect the discounted expected value of future flows and be used in permanent transfers. In between the temporary flow and permanent stock prices, the market is likely to develop a range of lease and other arrangements for the transfer of water entitlements for a number of seasons or years. Because of geographical isolation, different relative aggregate demand and supply by region, and the high costs

of inter-connection infrastructure, different prices are likely for the different geographic water basins

Prices in the water market will respond to changes in demands of the different uses of water and to changes in water supply. On the demand side, changes could come from changes in the prices of products which use irrigation water as an input, changes in the government allocation of funds to purchase water for the environment, changes in urban populations and building codes affecting water needs, and from changes in technology affecting the efficiency of water and other production inputs. Supply changes could come from climate variation, both across seasons and from trends over time with climate change, and from investments in dams, delivery systems and by water users.

It seems likely that in time the finance industry will develop a range of options, futures, derivatives and related instruments to assist water users to hedge against the volatility of water prices and quantities where risk aversion is important.

A well functioning water market will improve the allocation of water and associated investment activities, both in a static sense and in response to changing future conditions, including changes which are not foreseen with perfect knowledge. In their own self interest, irrigators, other businesses, households (and in some cases the environmental manager) voluntarily will redistribute water from low value to high value uses and users at a market price which falls below the marginal value of the water to the buying higher value user and above the marginal value of the water to the selling lower value user. If land markets are to be taken as a comparative market indicator, not all individuals who could benefit by trade will in fact do so immediately on the formation of a water market because of satisficing behaviour and for non-commercial reasons, but over a number of years most mutually advantaged trades will occur as the true opportunity value of water becomes known.

With secure property rights, firms have the incentives and will reap the rewards of productive investment in new technology, such as water saving equipment and R&D into new cultivars, and of investments to increase effective water supply, such as piping and expanded delivery capacity. With a market, additional water gained or

saved can be sold as a market return on the investment outlay. Further, secure property rights, and the development of hedging instruments to spread risks, improve the ability of investors to borrow the required funds. For many of these investment opportunities, private firms have greater access to the necessary ideas, information and opportunities than is available to government investors.

The achievement of a more efficient allocation of limited water resources, whether by market forces or by government direction, necessarily involves structural changes and some redistribution effects. The grandfathering of existing property rights preserves the status quo at worst, and for most the shift from uncertain rights with a doubtful legal basis to secure property rights represents an improvement (at the expense of government). For the buyers and sellers of the property rights, the transfer is a voluntary Pareto exchange in which both parties gain in what is a positive sum game. The issue of potentially stranded water delivery assets was considered earlier, where it was noted that the alleged problems can be avoided by attaching a water delivery property right (with payment obligation) to the land whose value it enhances.

Possibly of more concern on equity criteria is the third parties who provide services to an intensive irrigation area, for examples farm hands, machinery sellers and maintenance providers, and local shop keepers, and who lose their livelihood in that region and need to geographically relocate when intensive irrigation farming, for example dairying, is replaced with extensive agriculture, for example beef. Such structural change is a normal aspect of regular economy evolution, although it might be argued that an unexpected change in government policy was the cause. Generally available social security and structural adjustment instruments, rather than a specific and special additional program, could be considered to provide an adequate minimum social safety net for these people.

6. Government Policy

There is much in the proposals of COAG (COAG, 2002 and 2004) and the White Paper (Victorian Government, 2004) which is positive and proactive to the greater use of market forces in the allocation of scarce Australian water resources. In particular, there is a path for providing secure water property rights, including some clarity on a

specific allocation for environmental flows. However, a number of rough edges and questionable parts of the proposals remain.

The White Paper in particular seeks to isolate and balkanise water for rural use and water for urban use. Effectively, it seeks to prevent urban users, and particularly Melbourne, from buying water from rural users[6]. Further, this restriction on market transactions is to apply not only to water flowing north of the great divide, but also on water flowing south of the divide. It also imposes additional charges on urban users to recover sunk capital costs and a higher environmental levy charge than is to be imposed on rural users[4]. This artificial categorisation of the water market fails to recognise that urban consumers are the final beneficiaries of most irrigation products, and that efficiency requires free choice between rice, fruit and vegetables from irrigation versus long showers and green lawns. Also, the separation seems to make a simplistic assumption that the retail prices of the irrigation products are insensitive to the costs of inputs including water inputs. Perhaps ironically, it is likely that Adelaide and country urban areas along the Murray and its tributaries will buy water from irrigators, but not Melbourne.

Current debate and policy about appropriate environmental flows is in the form of caps on water available for commercial uses and on the reallocation of X GL for the environment. These allocations almost certainly are a long way away from the economic framework of allocating water across environmental and commercial uses so as to equate marginal social benefits. Most of the current debate places an emphasis on flows per se, and then very little about the timing and form of the flows, and almost no reference is given to what will be gained in terms of more diversity, heritage and recreation from the extra water diverted to environmental flows, let alone any assessment of the value households attach to these extra environmental products relative to the opportunity value of water taken away from irrigation, industry and conventional household water uses. At a minimum, an economic estimate of the marginal social value of extra water for environmental flows should be included as a key information component in the political determination of these flows.

Both COAG and the White Paper have announced a raft of public funded investment projects to improve river flows and recycling which are to increase effective water

availability to meet environmental flow targets. These investment projects have not been submitted to a formal benefit cost assessment. In particular, the question as to whether such projects versus buying water from existing commercial users represent the most cost effective way of increasing environmental flows has not being contemplated. As higher incomes in the future are likely to mean increased demands for the provision of environmental amenity, a more logical cost effective route to acquiring additional water is desirable. Also, as discussed, a well functioning market will provide incentives and rewards for much socially beneficial investment to increase effective water supply.

7. Conclusions

Australia has been moving down a path of greater use of markets to allocate its scarce water supplies, and this process was given another push in 2004 with proposals from COAG (COAG, 2004) and the White Paper (Victorian Government, 2004). For those uses with largely private good characteristics, and this includes most water used for irrigation, industry and households, market prices provide a flexible coordination signal for the allocation and reallocation of supplies under changing circumstances and for complementary investment decisions affecting the supply of and demand for water. Government intervention to counter external pollution costs of waste water, and to allocate water for those public good property services provided by environmental flows, is required to complement competitive water markets. Granted the significant advances in water policy, there remain some important design flaws with the recent government proposals, and details of the specification of property rights and the operation of water markets remain to be fully developed.

Three general problem areas from an economic efficiency criterion perspective are noted with recent policy proposals. First, the separation or balkanisation of an urban water market from rural water markets creates efficiency losses. Second, the mechanistic assertion of required environmental flows is arbitrary and unlikely to focus on a required assessment of the marginal social value of changed allocations for environmental services. Third, the absence of formal cost benefit or cost effectiveness analysis of different options, including public funded investments and recycling versus market purchases, to meet environmental flow targets is likely to allow expensive interest group lobbying to dominate decisions.

How well water markets work is going to depend on the "devil in the detail" on such issues as the specification of property rights, the integrity and transparency of the market, and on the initial allocation of property rights. A number of options are explored in the paper. The White Paper proposals for unbundling rights into water entitlements, delivery rights and use licences for irrigation water has many attractive attributes, as does the proposal to formalise a high security entitlement and a low security entitlement. Grandfathering the current property rights, both for upstream as well as for downstream users, meets most perceptions of distributional equity and with clear property rights in time will lead to a reallocation of water from low value users and uses to higher value users and uses.

Endnotes

* I am grateful for the comments of Geoff Edwards and Alistair Watson on an earlier version, whilst retaining full responsibility for the views that follow.

1 This section draws on Edwards (2003) and Freebairn (2003).

2 Reference here is to the marginal value of water to a particular use, namely $P - \sum Wi\ Xi$, where P is the output price, Xi is the i-th non-water input and Wi is the cost of the i-th non-water input. Further, the marginal value of water will be a declining value of the amount used for each use. The marginal value of water does not necessarily correlate with the commonly reported dollars per megalitre of water, namely P / Xw, where P is output price and Xw is water per unit of product.

3 Note that for most rivers and canals with a continuous flow, for marginal changes in river and canal flows the additional losses are thought to be very small.

4 But, there is debate as to whether the health of major rivers has fallen or not, for example, Marohasy (2004).

4 I am grateful to Alistair Watson for alerting me to this issue. For a related point, on economic grounds there seems no rationale for the proposed three step block pricing scheme for urban water. In terms of opportunity costs and allocative efficiency, water is water whether it comes in small or large quantities suggesting a single price. Equity concerns are already largely met by a system of rebates for low income households with benefit cards.

6 Alistair Watson advises that regional towns in irrigation areas are not balkanised, including Euchuca, Mildura and Shepparton, but those not in irrigation areas are, including Bendigo and Castlemaine.

References

Coase, R. (1960), "The Problem of Social Cost", Journal of Law and Economics, 3, 114-127.

Council of Australian Governments (COAG) (1994), "Report of the Working Group on Water Resources Policy: Communique", February.

Council of Australian Governments (COAG) (2002), "National Water Initiative: Communique", December 6.

Council of Australian Governments (COAG) (2004), "Intergovernmental Agreement on a National Water Initiative: Communique", June 25.

Edwards, G. (2003), "Water Policy: Setting the Scene", Australian Economic Review, 36(2), 193-202.

Freebairn, J. (2003), "Principles for the Allocation of Scarce Water", Australian Economic Review, 36(2), 203-212.

Freebairn, J. (2004), "Water Rights for Variable Supplies", paper presented to Australian Agricultural and Resource Economics Society Annual Meeting, Melbourne.

Godden, L. (2003), "Perception of Water in Australian Law: Re-examining Rights and Responsibilities", paper presented at Australian Academy of Technological Sciences and Engineering, Melbourne.

Marohasy, J. (2004), "Myth & the Murray: Measuring the Real State of the River Environment", IPA Backgrounder, No 15/5, Melbourne.

Victorian Government (2003), Securing Our Water Future: Green Paper for Discussion, Department of Sustainability and Environment, Melbourne.

Victorian Government (2004), Securing Our Water Future Together, Department of Sustainability and Environment, Melbourne.

Young, M. and J. McColl (2003), "Robust Reform: The Case for a New Water Entitlement System for Australia", Australian Economic Review, 36(2), 225-234.