Thematic Week: Water Economics and Financing

Thematic Axis: Water Markets

Title: Water Markets and their Environmental, Social and Economic Impacts in Australia

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Abstract:

Water markets have been vigorously pursued in Australia as instruments to minimize the socioeconomic impact of increased scarcity and to provide water for environmental purposes. Initially markets were hesitantly adopted by irrigators but over the last ten years market participation has increased significantly both in the entitlement and allocation market, but most predominantly in the allocation market. There is evidence that both markets have facilitated the anticipated reallocation of water with the associated socioeconomic benefits. There are however also evidence of declining rural communities as a result of drought and policy induced scarcity or, as some argue, as a result of the operations of water markets. There is however no real evidence whether this decline has been caused by scarcity or markets; or whether, in fact, markets have reduced the socioeconomic and community impact of scarcity. With the latest generation of legislative changes, including statutory based water planning processes defining the consumptive pool of water and provisions for environmental and other public benefits, more secure water entitlements and water registers and an unbundling of the rights embedded in the traditional water entitlement, the scene seems to be set for the introduction of more sophisticated water market instruments and water products

Keywords: Water markets, market instruments, Australia, socio-economic impact, environmental impact.

Introduction

Water demand throughout the world is increasing as a consequence of population growth, changing diets, economic growth, and, since the 1970s, also due to changing environmental values and growing recreational demand. In the future these forces will continue to increase demand while increases in supply will be limited due to the impact of the predicted climate change and limited opportunities for new major water supply infrastructure within sustainable economic, environmental and political constraints. As a consequence water scarcity will increase, especially within semiarid and arid regions. Failing to meet these growing demands will have significant environmental, social and economic implications especially within low to middle income countries where water is a key component in reducing poverty and improving public health.

Reflecting these developments and concerns there has been a major shift in water policy away from supply management; that is, meeting new demand with increased supply, to demand management; that is, meeting new demand by using existing supply more efficiently and reallocating water from existing to new users. This shift has also changed the perception of water from being a social good to being an economic good, which should be allocated according to market forces. An important element of the new paradigm is the use of market instruments such as full cost recovery prices, private property rights, water markets, and privatization. Many donor agencies such as the World Bank have therefore included such reforms as conditions of funding for construction of major water infrastructure such as dams and urban supply and sanitation. Treating water as an economic good is alien to many cultures. These reforms have therefore been met with considerable and in some cases violent opposition in countries such as Bolivia and Sri Lanka.

The new policy paradigm has been aggressively pursued in Australia since the early 1990s in response to serious environmental consequences of overexploitation of the largest water resource – the Murray-Darling Basin (MDB). Market instruments, such as water markets, full cost recovery prices and privatization, have therefore been introduced. In some places water markets have been widely adopted by irrigators to manage scarcity and structural change. Australia therefore represents an interesting case study for countries considering introducing the same changes.

This paper first discusses how water markets have developed in Australia and outlines some of the concerns associated with their introduction and how jurisdictions have tried to deal with these concerns. The second section discusses how market activities and prices have increased over time, how farm businesses have adopted markets, and how important markets are today in determining how water is allocated. The third section analysis the social, environmental and economic outcomes and impacts of market operations. The final section provides some discussion of how water markets could be improved to better achieve policy expectations. While the paper is in an Australian context, it concentrates on developments within the MDB, and most examples are from the Goulburn-Murray Irrigation District in Victoria (GMID), Australia's largest irrigation district

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1 Development of water markets in Australia.

It is important to understand that two different markets exist: i) the entitlement market in which the long-term rights to receive water allocations are traded; and ii) the allocation market in which such allocations are traded. In essence the entitlement markets trades in paper rights to future access to water, whereas the allocation market trades in actual volumes of water which can be extracted from a source during a specific season. In most Australian States there are two kinds of entitlements. Irrigators within irrigation district have entitlements to get allocations delivered to their farms using the district's infrastructure while irrigators outside districts have entitlements to extract their allocations directly from the source using their own pumps and infrastructure to transport the water to their fields. These are often referred to as district irrigators and private diverters respectively.

1.1 Policy development

Markets for both water allocations and entitlements were first introduced in South Australia (SA) in 1984. Scarcity in this State emerged first as the State Government placed a moratorium on new entitlements and actually cut existing entitlements according to history of use during the 1970s. When demand from new efficient and high value water users, especially horticulture and viticulture, emerged there was therefore an urgent demand for a mechanism to reallocate water from existing to new users and, given the nature of these new industries, entitlement trading was perceived necessary to justify the long-term investment. In the other States allocation trading was introduced first due to considerable community concern over the potential impact of entitlement trading. Allocation markets were introduced in New South Wales (NSW) in 1984 and were piloted in Victoria in 1987. Entitlement markets were introduced in NSW in 1989, but for district irrigators did not take effect until the districts were privatized in the mid to late 1990s. In Victoria, both allocation and entitlement trading was formally introduced with the Water Act 1989. However, entitlement trading did not commence until late 1991, when the necessary regulations were approved. Water markets have since been aggressively promoted on the national and basin levels.

In 1994 water reforms accelerated when the Council of Australian Governments (CoAG) agreed on a new water reform agenda. This agenda included a commitment by all jurisdictions to, among other things, introduce market instruments such as water trading, full cost recovery prices, and privatization of the water industry as well as to provide formal entitlements to the environment.

In response to growing environmental concerns an audit of water use within the MDB was initiated in 1995. It concluded that the level of water use was far in excess of what was ecologically sustainable, and worse, it would continue to increase as previously unused entitlements would be activated – the likelihood of this was increasing with the introduction of water trading. The Audit predicted significant environmental impact if this was allowed to happen. In 1996 it was therefore decided to place a cap on each State's water use set at the volume that would have been used at the 1993/94 level of development. With total use capped, and trading activating previously unused water, demand on available resources increased resulting in lower seasonal allocations.

In 2003, CoAG reviewed the 1994 reform agenda and found that good progress was being made, but that the existing water market mechanisms still prevented water markets from achieving their most beneficial outcomes. In 2004 CoAG therefore introduced a new National Water Initiative (NWI). Among other things, it aimed to improve the operation of water markets and to encourage the emergence of markets in more sophisticated derivative water products by providing: a) better specified and nationally compatible water entitlements, defined as shares of the available resource; b) secure water entitlement registers; and c) national functioning water markets including the progressive removal of barriers to trade. Three other important elements of the NWI, increasing the pressure for more efficient water markets, are: i) statutory-based water planning processes defining the consumptive pool of a resource and ii) statutory provisions for environmental and other public benefit outcomes and improved environmental management practices; and iii) a commitment to return all currently over allocated or overused systems to environmentally sustainable levels of extraction. Now overarching water trading rules are set out in the national Water Act 2007.

In compliance with the CoAG water reform agenda and the MDB Cap, State water policies have undergone considerable changes, with new legislation introduced in South Australia in 1997 and again in 2004, in NSW and Queensland in 2000, and in Victoria in 2005. As a part of this process most water authorities have revised their seasonal allocation policies. Traditionally the authorities announced seasonal allocations as a percentage of total entitlement at the beginning of the season based on water availability in the reservoirs and predicted seasonal flows based on historical data. This policy provided certainty for irrigators, who could plan their production based on these allocations. Due to historically exceptionally dry years this policy got some states into trouble. Today, most authorities therefore announce the allocation at the beginning of the season based only on what is available in the reservoirs and minimum expected inflows, and then revise this allocation on a regular basis as additional water enters the reservoirs. While this may represent a more sound environmental policy, it has resulted in irrigators having to plan their production without full knowledge of how much water is available and therefore has increased the need for efficient markets to help manage this increased uncertainty and risk.

These policy changes have reduced the volume of water available for consumptive use from most resources. This has had two consequences: i) in many catchments irrigators' entitlements to water have been reduced without compensation; and ii) seasonal allocations have declined. This second effect is however not only a consequence of policy changes but also, and maybe predominantly, a consequence of drought in the basin which has been ongoing for more than eight years (only two out of the last ten years have had above the long-term median inflows). This has caused increased water scarcity and has put increased pressure on water markets to allow water users to manage this scarcity by moving the available water around so that total socioeconomic impact is reduced. Increasingly governments and the MDB authority are looking at the market as a key mechanism to ensure environmental water.

In response to this increased pressure on water markets water exchanges have emerged since 1998 providing fast, efficient, affordable approval and transfer processes especially for trading in water allocations. However, similar markets for entitlements are also emerging.

The following sections will discuss the Economic drivers of, and the environmental and socioeconomic concerns over the increased role of water markets as well as the mechanisms introduced to deal with these concern.

1.2 The economic argument

The economic arguments for water markets are appealing and convincing. Water available for extractive use is decreasing. Originally water was allocated in abundance at low or no cost resulting in excessive water use, rising water tables and increasing soil salinization. Often irrigation was developed on unsuitable and unproductive soils and in locations where the runoff or leaching had a negative impact on river water quality. Further, many of the irrigators were on small lots with inefficient irrigation technology and using water to produce low value commodities. Many of these farmers did not have the financial or human capacity to improve their productivity. There was therefore a need to remove water from this land and these users; with water attached to land this was not possible. The economic argument is therefore that water entitlements need to be removed from land and efficient markets introduced which allow water to move to more efficient and higher value users on better land and in more appropriate locations. This will maximize the economic return from the resource and reduce the socioeconomic impact of declining access to water for consumptive use while compensating those giving up their water in the process. This would also improve river water quality.

The economic argument also covers the impact of drought. During drought allocations are low and there is not enough water to maintain 'normal' production. During such periods markets will allow water to move to the highest value users and more importantly to users with significant investments in water dependent assets such as horticultural plantings and dairy herds. These productions can suffer significant permanent or long-term damage from insufficient irrigation. As a result of insufficient watering trees and vines can die or suffer long-term reductions in yields. Dairy farmers might have to reduce their herds if they can not irrigate their pastures, reducing herds and subsequently increasing them again is very costly. Such capital intensive productions is often associated with high levels of debt requiring constant servicing, reduced annual productions therefore have significant cash flow implications. It is therefore imperative that these irrigators can get access to water during periods of drought. On the other hand most low value producers are involved in annual cropping which can be reduced or expanded without long-term implications. These farmers should be well compensated by selling their water to the high value producers during drought as these will be willing to pay high prices to protect their long-term investments.

1.3 Environmental concern and mechanisms to alleviate concern

The environment has been at the centre of much of the debate over water trading. Concern has been expressed over issues associated with the impact that water use might have in the new location or the purpose to which the new user might put it. Trade might: i) concentrate water use in areas suffering from high water tables; ii) move water into locations where its use might have a negative impact on river water quality; iii) move water use upstream resulting in reduced river flow from the new point of extraction to the old point of extraction; or vi) activate previously unused water leaving less water in the river to support ecosystems. Concerns have also been expressed about the impact on the exporting land.

To accommodate these concerns all State governments introduced various restrictions on trade as well as approval processes to ensure that the transfer of water would not cause any environmental damage. For example:

- in SA buyers had to produce an Irrigation Drainage and Management Plan to prove that the intended use of the water would not have a negative impact on river water quality;
- in Victoria there were limits on how much water could be traded onto a particular parcel of land. The allowable volume of water depended on the irrigation and drainage infrastructure as well as the soil type of the property;
- these limits were changed to not limit the volume of water attached to a specific parcel of land but the volume that could be used. This allowed irrigators to buy extra entitlements so that they could continue to use the maximum volume during periods of low allocations;
- the requirements of certain drainage and irrigation infrastructure was later replaced by reference to plans showing best irrigation and management practices on suitable soils;
- spatial restrictions were placed on transfer of water. These restrictions have constantly been modified and made more flexible;
- low and high impact zones have been identified with trading of water into identified high impact zones being prohibited or associated with payment of a levy; whereas trading out was encouraged by a government payment in excess of market price; and,
- exchange rates have been introduced when water is traded between different locations on the river to offset the impact on stream flow and transmission losses.

These restrictions on trade proved to significantly increase transaction costs both in time and money and thus curtailing particularly the entitlement market. To overcome this problem the right to use the water has been unbundled from the ownership of the water entitlement. South Australia was the first State to put this into effect when they introduced two types of licenses: a holding license and a taking license. Any person can purchase water entitlements and get a holding license. This do, however, not include any right to use the water, to do that a water user must have a taking license, which in turn requires that the user can prove no adverse impact on river water quality. However, the owner of a holding license can lease the water out to another user with a taking license. This separates the trading process from the approval process and thus frees up the market. Since then, as part of the unbundling process, most states have separated the water entitlement from the water use right with a similar effect to the system in SA.

1.4 Social and Community concerns and mechanisms to alleviate them

Social and community impacts have, together with environmental impacts, been the most important factors causing community concerns over the impact of water markets and especially the markets in water entitlements. These concerns were apparent when markets were first introduced and were the reasons why allocation markets where first introduced, as it was perceived that the temporary re-allocation of water from one user to another would not have permanent impacts as the long-term entitlement to the water remained in the same location. These concerns were associated with the impact on the individual farmer’s welfare and on the welfare of the wider rural community depending on irrigation as the engine of economic activity. The potential impacts on the individual irrigators were mainly associated with the impact on the irrigators not selling:

- when water is traded out of a supply system; then, given full cost recovery pricing, the cost to remaining irrigators will increase as the maintenance and supply cost are largely fixed;
- if a major part of the water is traded out of a supply channel the water authority might find it unviable to keep supplying water through that channel and close it down, forcing remaining farmers to stop irrigating, leaving both irrigators and authorities with stranded assets;
- selling water off the poorer soil might result in abandoned farmland with absentee land owners. This could result in land being left unattended as havens for weeds and pests, which will spread to neighboring properties. Or absentee landholders might keep token stock on their property neglecting to maintain fences resulting in roaming livestock.
- the separation of land and water rights and the separation of water entitlements and use rights give speculators an opportunity to buy up water. It is feared that such speculators, often called 'Water Barons', will horde water, gain a monopoly position and restrict supply or press up prices to levels in excess of what irrigators can afford.

Traditionally these concerns were overcome by the existence of barrier to trade out of districts. However, under the NWI and the new Water Act these restrictions have to be removed or significantly reduced giving rise to renewed concern. As part of the new water policies a separate supply capacity entitlement has been introduced and the fixed costs of maintaining the supply infrastructure are being charged to this entitlement. If irrigators sell their water entitlements, they still retain their capacity entitlements and remain responsible to pay these charges. This effectively ensures the viability of supply systems and keeps the cost for remaining irrigators constant. In Victoria the Government has acknowledged that trading already has moved so much water out of some channels that it will be necessary to close them down. In this respect the government has guaranteed the remaining irrigators that they will be compensated for the resulting loss in property value. Finally to overcome the concern over 'Water Barons' the Victorian Government has introduced a limit of 10% on how big a proportion a single entity can own of a certain water source.

The concerns of the wider community are associated with the following main issues:

- If water is traded out of a given are the value of the farm produce in this area will decline. Dry land farming is far less productive than irrigated farming and often requires far les farm labor, processing, packaging, services, farm inputs etc. A substantial reduction in irrigated activity therefore will result in fewer jobs both on-farm and off-farm, less demand on local businesses servicing the farming industry either by providing services such as accountants and irrigation consultants or by selling farm inputs and machinery. This in turn will reduce demand for labor in the local towns and a reduction in services for the remaining citizens. If both on-farm and off-farm work as well as demand for local businesses are reduced there is a fear that people will leave the area further escalating the depopulation and de-servicing of the area resulting in a lack of services such as schools, hospitals, and doctors, local shops, and recreational opportunities such as sporting clubs.
- If irrigation water is traded away from a farm then the land value will decline. If land values declines then the rating base for the local council will decline. A declining rating base can result in two things. Either services such as road maintenance, libraries, hospitals and schools are reduced or other rate payers have to pay higher rates.
- If people are leaving the areas then demand for properties will decline and property values will go down. This will leave remaining citizens with a declining asset base and can be an incentive for people on low income or transfer income to move to the area to make their transfer income stretch further. This can change the make up of the community.

While both the federal and State Governments have stayed away from promising structural adjustment assistant to affected communities both the National Water Initiative and State policies have indicated a willingness to consider such assistant if impacts develop to be too adverse. To maintain the rating base most states are introducing changes to property valuation which will allow them to levy irrigated property more than dry land properties. For example in South Australia Commandable land (that is land capable of being irrigated) has a much higher value than dry land.

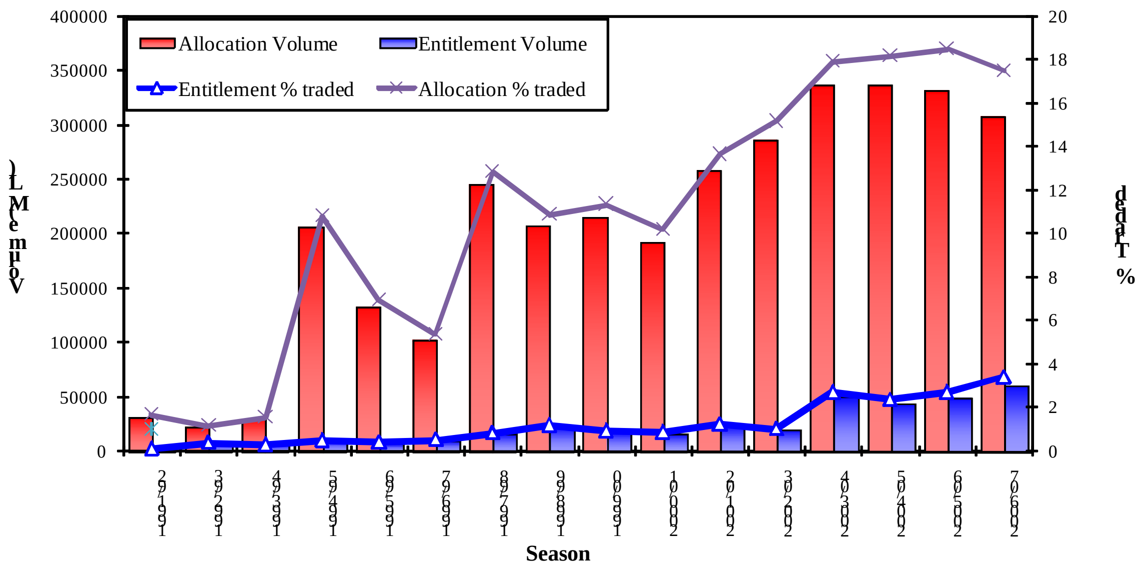
2 Market activities and prices within the GMID

For markets to have a meaningful impact whether that is the anticipated positive impacts or the feared environmental and social impacts, trading need to be adopted by irrigators so that trading has a real impact on the way water is allocated. This part therefore discusses how water markets activities have developed since the early 1990s predominantly based on the authors research within the GMID (Bjornlund and Rossini, 2008, 2005, 2007; Bjornlund, 2006).

2.1 Volume traded in allocation and entitlement markets

Trading in both the allocation and entitlement market within the GMID was initially very subdued as irrigators were unfamiliar with the concept and there were substantial concerns within the community (Figure1). Only one to two percent of the entitlement base or less than 30,000 ML were traded each year in the allocation market for the first five years. An initial increase took place in 1994/95 as some trading restrictions were removed. Since 1997, which was the first of many drought years, and the change to allocation rules in 1998, trading has consistently been above 10% of the entitlement base or in excess of 200,000 ML. To deal with this volume of trade within a reasonable timeframe the Northern Victorian Water Exchange was introduced in 1998. It processed all allocation transfers within one week using a bidding system. With the onset of sever drought in 2002 (table 1) trading has increased to more than 300,000 ML or around 18% per year.

Figure 1 Development of trading within the GMID 1991 to 2007



Trading in the entitlement market was even slower to accelerate, it took 12 years before the volume traded exceeded one percent of the entitlement base per year. Not until severe scarcity and escalating allocation prices emerged in 2002 (see part 2.4) did activities in the entitlement market accelerate, exceeding 3% for the first time in 2007. Initially there was a willingness to rely on allocation trading to make up for declining seasonal allocations. Prices paid in the allocation market were reasonable and with the new water exchange transfers were fast and reliable. However, during 2002/03 prices soared and many farmers in desperate need to irrigate paid loss making prices, and faced a weekly uncertainty whether they would be successful in their bid on the Exchange. This caused much anxiety and resulted in an increased willingness to invest in water entitlements. Initially the entitlement market had limited impact on who owned water, only 6.3% of all entitlement changed hand over the first 10 years. However, by the end of 2007 about 20% of all entitlements had been traded.

Looking at the spatial redistribution of water both within the GMID and to outside the GMID, causing the concerns expressed by the community, GMID had in total lost 7% of all its water by June 2007. This water had been traded downstream to supply the growing horticultural industry (in particular wine grapes, olives and almonds) in Sunraysia in Victoria and in SA. While all regions within the GMID have suffered a reduction in water entitlements, the magnitude of the reduction differs significantly across the GMID. Most parts have so far seen minimal reductions; however, some districts have lost as much as 13% as of 30 June 2006.

Table 1: Relationship between seasonal allocations and extent of trade within the GMID

	Goulburn System			Murray System		
Season	Allocation (%) Opening	Allocation (%) Closing	% of trade[1]	Allocation (%) Opening	Allocation (%) Closing	% of trade[1]
1995/96	150	150	7	150	200	3
1996/97	200	200	4	200	200	3
1997/98	120	120	9	130	130	13
1998/99	40	100	13	95	200	5
1999/00	35	100	14	100	200	8
2000/01	48	100	16	200	200	2
2001/02	55	100	18	200	200	5
2002/03	34	57	24	129	129	16
2003/04	0	100	16	18	100	18
2004/05	0	100	18	42	100	22
2005/06	0	100	22	82	144	14
2006/07	0	29	37	76	95	20
2007/08	0	57		0	43	

Source: Based on Goulburn–Murray Water's Records [1] total water trade for season as percentage of total water use

2.2 Markets' ability to determine who actually gets access to use water each year

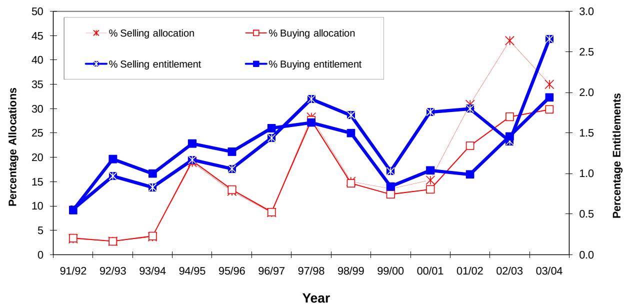
Another measure of the impact of the allocation market is the extent to which it determines who can use water each season. Initially trading only accounted for a relatively small proportion of total water use (table 1). There is a clear link between the allocation level and the importance of trading in determining who can use water that season. When allocation levels are at historical levels, 150% to 200%, trading accounts for a small proportion of total water use. This level, around three to five percent, possibly represents irrigators making marginal adjustments to their water availability in response to fluctuating prices and supply and demand for the crops they are producing. However, when allocation levels dropped below 150% to 100% and even lower, and when the allocation mechanism was changed in 1998, the allocation market played an increasingly crucial role in determining who can use water. Allocation trading accounts for up to one fifth of all water use at 100% allocation, one quarter at 57% allocation and more than one third at 29% allocation (table 1).

From a slow start, it by now seems that both entitlement and allocation markets are having a significant impact on who owns and uses water both in the long and short term. However, there is no doubt that the most significant re-allocation of water takes place in the allocation market where it is determined who can actually use water each season rather than who owns the underlying paper right to receive water in the future.

2.3 Market participation and the rate of markets adoption

When considering whether markets play an important role in determining who gets access to water and thereby assisting farmers in managing their water supply, the level of market participation is an important measure (figure 2)

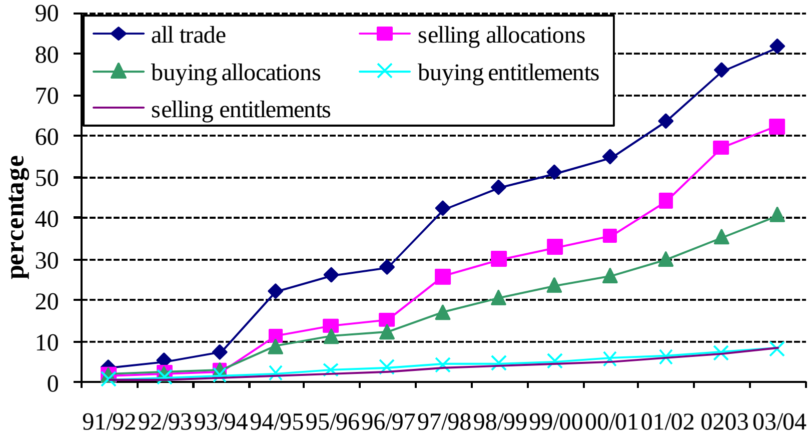
Figure 2: % of farm businesses buying and selling allocatins and entitlements annually



Market participation was originally very low with less than five percent of farm businesses buying or selling allocations each year during the first three years. The participation rate clearly has three peaks (figure 2). A significant increase to some 18% took place in 1994/95 following easing of trading restrictions. The next two peaks in 1997/98 and 2002/03 were caused by scarcity. The season of 1997/98 was the first time allocation levels dropped towards 100% and 2002/03 was the first time it dropped below 100% (table 1). It is clearly scarcity which is the dominant driver of activities in the allocation market. It can also be noted that for the first years almost the same percentage of farm businesses were buying and selling water allocations. This, however, changed so that by now there is far more businesses selling than buying. This development is driven by two forces. First, the introduction of trading to outside the GMID in 1995 for allocation and in1997 for entitlement trading, however such trade did not really take off until increased wine grape prices caused the planting of wine grapes to explode in 1999. Second, increased water prices have caused more small entitlement holders to enter the market as sellers. At low prices it is not worth while for these small entitlement holders to bother about selling. On the other hand, with increased scarcity buyers are frantically buying water wherever they can find it and often have to buy many small parcels to cover their needs. By 2004 about 30% of all farm businesses were buying allocations each year and 35% selling. At this time it must be concluded that the allocation market is being used regularly and routinely by the majority of irrigators as a tool to manage their water use.

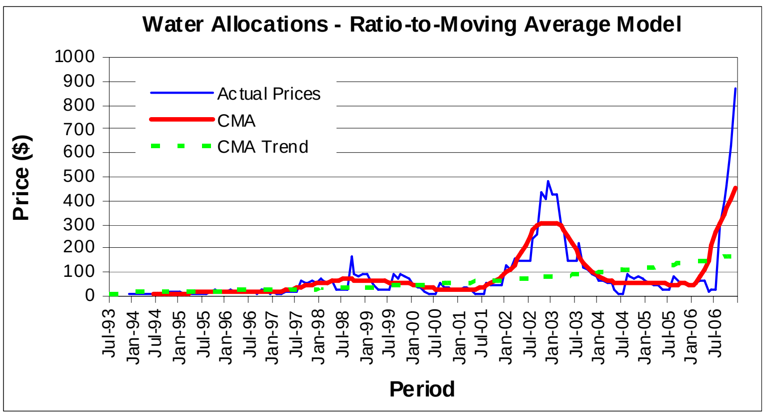
The participation in the entitlement market is much lower but increasing at about the same rate as in the allocation market. During the first year only around half a percent of all farm businesses bought and sold water entitlements, this only slowly increased to one percent during the following years. As in the allocation market the participation rate first peaked in 1994/95 with the easing of trading restrictions. Especially important in this market was the enabling of trade between district irrigators and private diverters as there were a large number of unused entitlements among private diverters. During the first year of low allocation the participation rate increased to a peak of around two percent. Over the following four years the participation in the selling market remained rather stable (except for a drop in 99/00) while the participation as buyers remained at a lower level of about one percent. The higher level of participation in the selling market, especially after 1999, is again associated with the boom in the wine grape industry. With the continued and worsening drought since 2001 the participation rates both as buyers and sellers have increased to about two percent for buyer and 2.7% for sellers.

Figure 3: The Adoption rate of water markets within the GMID, Victoria



Looking at the rate at which farm businesses adopted the use of water markets again indicates a slow initial uptake. Over the first three years less than ten percent of all farm businesses participated in some kind of trading (Figure 3). With the easing of trading restriction in 1994 this jumped to more than 20%. By 1997/98, the first year of low allocation, over 40% had used the market at least once. Since then more and more farm businesses have taken up using the water market in response to the changing allocation policies and continued low allocation levels. At the end of the 2003/04 season 81.4% of all farm businesses had participated in some kind of water trading: i) 9.6% had sold entitlements; ii) 9.6% had bought entitlements; iii) 49.8% had bought allocation; and iv) 62.4% had sold allocations. This emphasizes that by 2004 the use of water markets had been widely adopted as a way of adjusting the long and short-term access to water.

Figure 4: Allocation Prices 1993 to 2007 – trend and seasonality

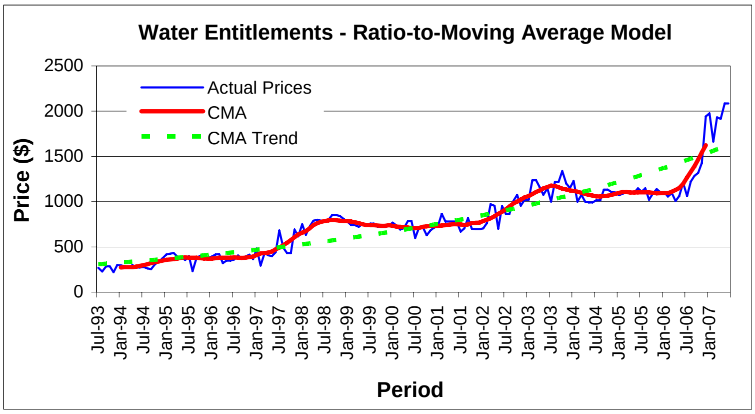


Monthly Growth	1.5%
Annual Growth	20.2%
Seasonal Indices	
Jan	1.237
Feb	1.078
Mar	0.934
Apr	0.820
May	0.542
Jun	0.551
Jul	0.543
Aug	1.233
Sep	1.238
Oct	1.307
Nov	1.274
Dec	1.243

2.4 Price development

Prices in both the allocation and the entitlement market have increased considerably over time with an annual growth of 20.2% and 12.3% respectively (figures 4 and 5). Allocation prices show significant seasonal variation and fluctuate widely within and between seasons in response to changes in the scarcity level driven both by the allocation level and in rainfall and evaporation. With prices first reaching A$500 per ML (1000m3) in 2002/03 and A$1,000 in 2006/07 they had far exceeded what can be financially justified for most agricultural productions. Analyses of water prices and the price of commodities show strong negative correlations suggesting that irrigators pay higher and higher prices for water while they receive lower and lower prices for their commodities. This suggests that during times of severe scarcity farmers are not buying water to increase their profit in response to good commodity prices. Buyers are irrigators with significant investment in water dependent assets such as horticulture and dairy. They are buying to minimize their losses by protecting these assets and to stay in business with the expectation of better conditions in seasons to come. There are also many examples of banks lending farm businesses money to purchase water at these prices, knowing that it will generate negative farm income as the banks have an interest in helping these farm businesses to survive so that they can service their debt in years to come.

Figure 5: Entitlement prices 1993 to 2007 – trend and seasonality



Monthly Growth	1.0%
Annual Growth	12.3%
Seasonal Indices	
Jan	1.052
Feb	1.009
Mar	1.045
Apr	0.998
May	0.970
Jun	0.997
Jul	0.978
Aug	0.951
Sep	0.982
Oct	0.989
Nov	1.016
Dec	1.013

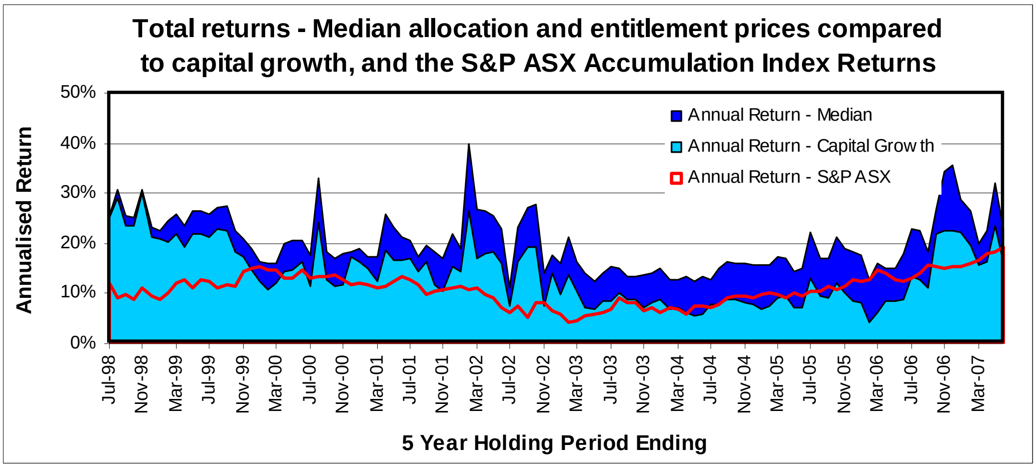
Entitlement prices have not increased nearly as much as allocation prices (figures 4 and 5); they also do not show significant fluctuations within and between seasons. The centered moving average seems to have three shifts in price level. The first price increase from below $500 to near $1,000 took place up to 1999 driven by high prices for wine grapes. As that industry stagnated prices leveled out and even slightly decreased. The next shift to over $1,000 took place during 2002/03 and into 2003/04 as allocations dropped below 100% and allocation prices increased. Prices then leveled out again, and even declined a little during the next two seasons of higher allocation levels. The final shift is still ongoing with prices now exceeding $2,000 in response to even lower allocation levels. Price analyses show that there are two main drivers of entitlement prices: i) scarcity measured by the level of seasonal allocations, and ii) the price of water allocations. Analyses of cycle factors for water allocation and entitlement prices indicate that the two prices follow the same cyclical movement but that allocation prices fluctuate more than twice as much as allocation prices. However there is some influence of commodity prices in the form of the price of wine grapes.

2.5 Return on investment

In a water management system where environmental and social water needs are looked after through statutory water planning processes it will be reasonable to pursue the economically most efficient use of the water available for consumptive use. It has been widely recognized that to maximize economic benefit from water more sophisticated and flexible market mechanisms and water product will be needed. The changes introduced with the NWI, the national Water Act, and new State legislation have created the foundation for the emergence of such mechanisms and products. Increased market participation and market activity suggests an increased familiarity with the market institution and the link between entitlement and allocation prices and the existence of market intermediaries suggest that the fundamentals for more sophisticated markets are emerging.

Analyzing the returns that could be obtained from investing in water entitlements will further indicated whether the time is right to introduce such markets and products. Figure 6 shows the return that could have been obtained from investing in water entitlements with the purpose of selling the seasonal allocations during a five year holding period and selling it again with the expectation of some financial gain. This is similar to what investors do in share markets and property markets. The analyses indicate that return fluctuates depending on when the entitlement is purchased and the strategy followed when deciding when to sell the allocations. The returns in figure 6 are based on allocations being sold at the median price each year and should thus be conservative. The red line reflects the return that could have been achieved if the money had been invested in the Australian Share Index. Returns from investing in water entitlement over this 13 year period have consistently been well above what could have been achieved in the share market. During the early years most of the return was generated by capital growth, however in more resent time there has been a balance between annual cash flows and capital gain. These findings further suggest that the fundamentals are emerging for more sophisticated markets and water products.

Figure 6: Total return, capital growth and the S&P ASX accumulation index



3 Market outcomes and impacts

The following sections discuss the economic, social and environmental impacts identified by previous research, mainly carried out by the author (Bjornlund 2002, 2007, 2008; Edwards et al, 2008).

3.1 Economic impact

Economic analyses of the early markets in NSW indicated an annual benefit to agriculture from allocation trade of up to $10 million per year by 1991 and 35 million from entitlement trade by 1999. These studies are however limited and few other estimates have been made. Surveys of buyers and sellers of water allocations and entitlements indicate that the anticipated reallocation of water has taken place. Water in both markets has moved from lower value producing and less efficient to higher value producing and more efficient users. This has increased both the volume of produce and dollar value per unit of water used. Originally the dairy industry dominated the market as buyers. This dominance declined over time due to falling commodity prices and deregulation of the industry. Today dairy is still the predominant buyer in both markets but not as dominant as in the early to mid 1990s. Since 2003 there is evidence that water is reallocated to farm businesses who concentrate on one product i.e. diary, cattle, sheep or horticulture. It seems that high value users have emerged within nieces of productions which were previously not considered high value.

The most significant reallocation has been associated with trading to outside the GMID. This water has traded downstream and been used for new or expanding horticultural industries with a very high gross margin per unit of water used; this could not have occurred without water trading. Without considering the regional impact of such reallocation, there is little doubt that overall the economic activity generated by the available water has increased.

Probably the most important economic impact within the GMID has been the market's ability to assist irrigators in managing increased water scarcity. Even though more than 90% of irrigators tell us that they do not like water markets, they all depend on it to cope with scarcity and change. By now more than 80% of all farm businesses have used the market and many acknowledge quite readily that without it they would not have been in business today. Without water markets many high value users would have lost their planting or dairy herds and would have been forced off their property. Similarly many grazing, cropping or mixed farm businesses would have been out of business or suffering far worse than they are. With only little water they would not have made much money on their low value products. However, with water markets they received more from selling their water than they could ever have made using it. Many low value producers have a gross margin of $50-100/ML. During this period they have received $300-1,000/ML, so even with an allocation of 50% they are better of selling the water.

The research by Frontier Economics et al. (2007) argues that the regional impact of water trading has been minimal. They acknowledge that a lot of water entitlements have moved down stream but argue that trading in the allocation market has moved water upstream resulting in almost unchanged water consumption. This off-set is however likely to be temporal. Many downstream users initially bought entitlements enough to cover their needs once their developments are in full production and therefore initially have excess water. This surplus will disappear as these enterprises are fully developed and the plantings reach maturity. Then, at least in dry years, there is unlikely to be much water available to be traded upstream in the allocation market. How much water will be available for such trade during years of 'normal' supply remains to be seen and will depend on what allocation level these enterprises have based their water entitlements.

However, only a combination of annual cropping and permanent plantings can ensure the best possible economic outcome. If permanent plantings are developed to use all the available water during year of normal or high supply, then some of these will be lost during years of low supply as nobody will be willing to sell water allocations. Only by a balance of annual and permanent productions can economic outcome be maximized so that during dry years annual producers stop irrigation and during seasons of high supply annual producers can use the excess water to generate extra income. Who owns the entitlements will depend on who want to/can afford to hold the entitlements on their balance sheets. Will farm businesses with permanent plantings consider water entitlements as a good investment with the prospect of future capital gain and therefore buy enough water entitlements to secure supply in all years, and then sell back to the annual producers during years of amble supply. Or will the annual producers, who now hold most of these entitlements, be reluctant to sell as they expect significant future capital gains.

3.2 Social impact

It has not been possible to quantify social impacts within exporting communities based on changes in census data. Based on census data it seems that rural communities have shown resilience and managed to maintain population and economic activity despite the export of water. However, qualitative evidence, gathered through in-depth interviews with key stakeholders, indicates perceptions of change for the worse. However, neither the research by Edwards et al., nor by Fenton (2007) could identify causation of these changes between water markets or the drought.

Fenton and Edwards et al. agree that trading in water entitlements have seen the abandoning of many farms, especially diary farms and that much of this land now is left idle with the water sold off. The community reports negative impacts of this development. In some instance the building and dry land is abandoned resulting in infestations of weeds and pest, other properties are sold as dry land to city dwellers trying to find a cheap way to a farming lifestyle. This causes a change in the composition of the population from traditional farm families with many shared values and aspirations, to a mixed population with an increased emphasis on city values and without shared aspirations. Community members recent this development and therefore are against trading in entitlements. Irrigators who have sold all or part of their entitlement, but remained in the community, report severe social repercussions of their actions, such as being frozen out in the pub or in the shops in town, they are looked at as traitors. In the towns people also report a change in population. Many retiring farmers move into town after having sold their farm; that is seen as a good influence. Many traditional town dwellers have left as their jobs have disappeared and are being replaced by people who have retired or are on various transfer incomes, in search of a cheaper place to live. As a result, behavioral patterns in the schools are changing and the willingness to participate in the local clubs and societies which underpins the cultural life in the community, are declining. Respondents also report reductions in sporting clubs making it difficult for children to participate in sport activities. Finally, respondents report increased difficulty in recruiting volunteers among farming wives, who traditionally have been the backbone of voluntary work in schools, sporting clubs and day care facilities. This trend is strongly supported by survey data showing a significant increase in off-farm work dependence. Today most farming wives are working second jobs and are therefore not capable of voluntary work. These communities therefore see their social fabric disintegrating – even though census data do not support economic decline.

These changes within rural communities definitely take place; the question is whether water markets or the draught have caused them? The question is also whether these conditions would be even worse without water markets? If annual croppers could not have sold their water in the allocation market would they have been worse of? If farmers with permanent crops had not been able to buy water, would they have been worse off? Without water markets would there have been more bankruptcies, with people leaving the farm and the community in search of work? In the entitlement market, if the dairy farmers had not been able to sell their land and water separately would they have gone bankrupt and left in less favorable financial conditions? Now many of them have been able to move to the local towns and brought their money with them and continue to contribute to the community. Those who have only sold their water to clear their debt and now remain on the farm are still in the community and continue to contribute. Without this flexibility would these people have been forced to leave the area all together? These are valid questions.

Irrigators use the allocation market to manage scarcity and structural change. One group of irrigators have given up developing their farms to be viable. They use the allocation market to retain their lifestyle and stay within their community until the time of intergenerational change. Some sell all or most of their water to generate income, which combined with off-farm work and dry land farming, allow them to stay. Others buy a little extra water to keep their production going which allow them to stay. A second group uses the allocation market to facilitate the development of their property to become financially viable. Some buy water allocations to expand their production and/or spend their available capital on improving their irrigation and drainage infrastructure and then plan to buy more water entitlement once they have finished this process. Others already have the water for their fully developed farm; they sell their excess allocation while they develop their farm. Such sales help to finance the development. A third, much smaller group, consists of financially comfortable farmers; they buy or sell water in a more opportunistic way as they perceive they will be best off financially depending on current prices of commodities, farm input and water in the allocation market. From this perspective markets seem to assist farmers to stay on their farms and within their communities contributing to the resilience of these communities

3.3 *Environmental impact*

Environmental impacts of water trading are difficult to prove. Movements of water entitlements in a magnitude to cause real change have not really taken place. The farm plans implemented by entitlement buyers to ensure no negative impact have not been in place long enough to prove their effectiveness or otherwise. Developments allowed against payment of bonds towards remediating negative impacts have not existed long enough for negative impacts to occur and therefore test whether these bonds are adequate and whether their commitments to remedy negative impacts can be legally enforced.

However, these arrangements have been criticized because of the inability to enforce the obligations to remedy as well as due to the lack of monitoring of their implementation. On the positive side both entitlement and allocation trading is moving water out of properties using less efficient irrigation and drainage infrastructure and management practices to more efficient and better managed properties. Water has also moved out of poorer and degraded soils and to better soils. Such reallocations should reduce the negative impact on river water quality. However, it has been argue that the move to more efficient irrigators reduces return-flow to the river and thereby reduces river flows with negative impact on the environment. In Australia the irrigators have the consumptive use to the water they extract. That is, if they improve efficiency they can increase their irrigated area or sell the saved water. The net effect of either action is less return flow to the river.

4 How could market mechanisms and instruments be improved? Some concluding remarks

Water markets in Australia have been aggressively pursued by policy makers to ensure more efficient and productive use of water and to increase the provision of water for the environment. Irrigators have, after a slow start, widely adopted water markets, especially the market in water allocations. By now both markets have a significant influence on who can use water, but also an increasing influence on who owns the long-term entitlements to receive water allocations.

The regulatory developments in Australia have also been considerable; among other things providing: i) more efficient markets, more secure water entitlements, and an unbundling of the rights traditionally embedded in the water entitlements, and ii) adaptive statutory water planning processes which will ensure water for the environment and other public benefits and define how much water is available for extractive and consumptive uses. With these institutions in place the foundation is laid for the introduction of more sophisticated market instruments such as options, futures and conditional contracts. Once environmental and other public benefits are protected through regulatory processes there are no reasons for not letting markets move the remaining water around between competing users, to achieve the best possible economic outcome. For this to happen we need a balance between annual cropping, often considered as low value uses, and permanent plantings, often considered high value uses. Whether annual croppers are going to retain their entitlements and sell their allocations to those with permanent plantings during scarcity, or those with permanent plantings are going to buy the entitlements and sell the allocations to annual croppers during seasons of normal or high supply, or financial institutions, such as pension funds, are going to buy the entitlements and then sell the allocations to either annual croppers or those with permanent plantings, depending on the level scarcity, can be left to the market and be determined by individual risk preferences. The crucial point is that adaptive water planning processes are in place sufficiently robust to ensure environmental and other public benefits under continued climate change.

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