

# Increased participation in Australian water markets

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## Abstract

This paper examines evidence of the factors affecting the adoption of water markets within Australia's largest irrigation district, the Goulburn-Murray Irrigation District in Northern Victoria. The district is unique for the purpose of this analysis for a number of reasons: 1) irrigators are supplied by two main systems with very different supply reliability; 2) parts of the district have a high proportion of land suffering from soil degradation and salinity with low value production while other areas have better soils and higher value production; 3) market restrictions have been eased over time and vary across the district; 4) the district has experienced severe drought over the last six years; and 5) there are two different types of irrigators within the district, those supplied by the district infrastructure and those pumping their own water directly from the rivers with slightly different entitlements. The paper uses the trading and entitlement registers to analyze the trading behavior of all farm businesses during the first 13 years of trading both in the market for water entitlements and water allocations. Originally markets were adopted most extensively in the area with the largest potential financial tradeoffs between high and low value water users and irrigators with poor and good soils, while in the other parts of the district the main drivers of market participation have been scarcity and policy changes.

*Keywords:* water markets, market adoption, market participation, Australia.

## 1 Introduction

Water markets have been promoted by economists as a preferred instrument to reallocate scarce water resources within a mature water economy since the 1960s and 1970s. It was not until the early 1990s, however, that policy makers began in



earnest to promote markets as a preferred mechanism to reallocate water between competing users within arid and semi arid regions. Globally, water markets and other economic instruments were brought to the fore at the Earth Summit in 1992 and were embedded in the two key policy documents; the Rio Convention and Agenda 21. Since then, the use of market instruments has formed part of the water policies of international organizations such as in the World Bank as well as being promoted in by the OECD and FAO. Market instruments were part of a wider policy paradigm shift which included increased public participation in water planning and management, privatization of the water industry and a growing recognition of the environment as a legitimate water user.

Driven by significant environmental problems within its major water resource, the Murray-Darling Basin (the Basin), Australia has in many ways been at the forefront in implementing the new policy paradigm. In 1994, the Council of Australian Governments (CoAG) introduced a new Water Policy Reform Agenda embracing all elements of the new policy paradigm and in 2004 CoAG went further by launching a new National Water Initiative. Water markets are central in these and other associated documents related to the management of the Basin. Markets are seen as the main instrument by which water users can manage the process of reducing water extraction to provide adequate water for the environment and simultaneously secure a sustainable irrigation industry and thereby maintain a viable rural community. One of the main drivers of the new National Water Initiative was the need to provide improved market mechanisms to better achieve these objectives. Markets have therefore developed quite significantly in the three main states of the Basin since the early 1990s. Within Australia's largest irrigation district, the Goulburn-Murray Irrigation District (GMID), water markets have now formally been in operation for 14 years. It is therefore possible to make meaningful analyses of how this market has been adopted by irrigators, how the market participation rate of farm businesses has increased and identify the factors which have influenced this increase. These experiences should be valuable for policy makers and water managers in other parts of the world contemplating to introduce water markets. This paper is based on analyses of entitlement and trading registers of the GMID. The second part describes aspects of the GMID which are expected to determine the extent to which water markets are likely to be adopted. The third part provides an overview of the data sources used, while the remaining parts discuss the findings of the research.

## **2 Goulburn-Murray Irrigation District**

There are three main factors which could be expected to influence farm businesses willingness to use water markets: 1) more productive and higher valued water users on more suitable soils buying water from less productive and lower value users are likely to present mutually beneficial tradeoffs; 2) as trading restrictions are eased and more potential buyers and sellers are capable of making mutually beneficial tradeoffs and therefore more trading should take place; and 3) as supply is restricted due to increased scarcity either created by



drought or policy changes the need to use the market should increase as water users try to manage the impact of these changes. This section will discuss the extent to which these factors exist within the GMID.

The GMID consists of a number of districts, which are supplied by two main systems – the Goulburn and the Murray System (figure 1). Goulburn-Murray Water (GMW) administers the districts as well as the diversion licenses along the rivers within the district. The farm businesses fall within the following groups (figure 1):

- Almost 45% of farm businesses are within the eastern part of the Goulburn System which is dominated by dairy farms and some horticulture. This part has little soil degradation or salinity problems.
- About 5% of the farm businesses are located within the western part of the Goulburn System which is dominated by broad acre cropping, grazing and mixed farming. This part has large areas with poor and salt infected soils. Water entitlements within this area are much larger than within the other areas (table 1).

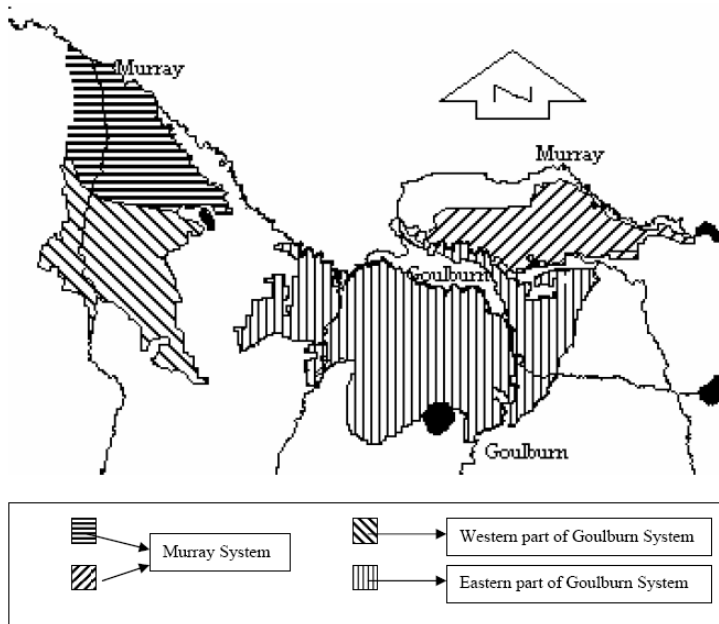


Figure 1: The Goulburn-Murray Irrigation District.

- 17.3% of all farm businesses base their irrigation on diversion licenses; that is they take water from the rivers using their own pumps and divert the water to their field using their own infrastructure. Traditionally these farm businesses have smaller entitlements (table 1) and less intensive irrigation and many had not developed their irrigation in full or part at the time trade

- between district irrigators and river diverters was introduced. There are also more non-commercial farmers in this category.
- Almost a third of the farm businesses are located within the Murray System. This system has two parts: a) the Murray Valley in the east, which is dominated by dairy production; and b) the western part, which have large sections in broad acre cropping and mixed grazing, with some areas having serious salinity problems. There are pockets with dairy production and new high value farms. The Murray System has in more recent history experienced considerably higher levels of seasonal allocations than the Goulburn System (table 2).

Table 1:        Distribution size of entitlement.

	All farm business	Goulburn West	Goulburn East	Murray	Diverters
10 ML or less	12.60	3.60	13.00	10.30	18.80
11 to 50 ML	24.60	7.70	24.50	21.80	32.10
51 to 150 ML	24.40	12.40	25.90	22.70	26.60
151 to 300 ML	19.50	27.40	19.00	23.00	14.00
301 ML or more	18.90	48.90	17.60	22.30	8.50

The figures in the Table show the percentage of farm businesses within each category

Table 2:        Allocation levels Goulburn and Murray Systems.

	Goulburn System		Murray System	
	Allocation	Opening allocation	Allocation	Opening allocations
1991/92	200	180	200	200
1992/93	200+	140	200+	180
1993/94	200+	200	200+	200
1994/95	200+	200	200+	200
1995/96	150	150	200	150
1996/97	200	200	200	200
1997/98	120	120	130	130
1998/99	100	40	200	95
1999/00	100	35	190	100
2000/01	100	48	200	200
2001/02	100	55	200	200
2002/03	57	34	129	129
2003/04	100	18	100	100

The development of market policies and the easing of trading restrictions have been incremental. Initially trading was restricted in order to alleviate community concern over the impact of trading. As irrigators became more familiar with the market and saw the potential benefits of trading, and as the need for trading increased due to reduced supply these restrictions were eased as follows:



- Trade both in entitlements and allocations were formally introduced by the Water Act 1989, while allocation trading was trialled within some districts in 1987.
- Trade in entitlements was not implemented until the regulations controlling this trade were introduced in 1991. Restrictions on trade were as follows: 1) no trade was allowed between district irrigators and river diverters; 2) only internal trade was allowed within the western part of the Murray System; 3) no trade was allowed within the eastern part of the Murray System; 4) within the western part of the Goulburn System internal trade was allowed and trade could take place from the western to the eastern part; and 5) water could, with only one limitation, be freely traded within the eastern part of the Goulburn System.
- In 1994 new regulations eased restrictions by allowing trading: 1) between district irrigators and river diverters; and 2) from the GMID and downstream into Sunraysia. This was expected to drive trade in that direction due to demand from horticulture and viticulture. The first transfers under this rule did not take place until 1997 when demand from new vineyards escalated.
- In 1995 restrictions were eased again allowing trade: 1) within the eastern part of the Murray System and from the eastern to the western part; 2) between the eastern and western parts of the Goulburn System; 3) from the Goulburn System to the Murray System; 4) in water allocations between states; and 5) in 'sales' water for district irrigators (Irrigators have two different entitlements. The entitlement itself is expected to be delivered in full 96 out of 100 years. In addition to their entitlement, users get additional water called 'sales' when reservoirs hold more water than what is needed for this and the following season.
- In 1997 restrictions were eased again by: 1) allowing interstate trading in entitlements; 2) restricting trade in 'sales' water to 30%; and 3) allowing trade from the Murray System upstream into the Goulburn System in substitution for downstream trade. This rule was implemented for the first time in January 2001;
- In 1998 the Northern Victoria Water Exchange was introduced providing fast, cheap and secure trading in allocations.

Two other policy issues combined with climatic conditions have also had an impact on water supply and supply risk within the GMID. In 1996 The Murray-Darling Basin Commission (MDBC) placed a cap on water extraction for consumptive use. According to this Cap no state can divert more water from the Basin in any given year than it would have done given the same climatic conditions at the 1993/94 level of development. Victoria's main tool to stay within the Cap was to reduce 'sales'. The introduction of the cap as well as an extended period of drought, has been contributing factors to lower allocations since 1997 (table 2). In 1998 GMW changed its allocation policy. Historically GMW announced allocations at the beginning of the season based on what was available in the reservoirs and expected inflows based on historical records. This provided certainty of supply for irrigators before planting and thereby committing to a certain level of water use. From 1998 GMW only incorporated



minimum expectations to inflows during the seasons when announcing opening allocations. This has resulted in much lower opening allocations (table 2), thereby transferring the risk of supply uncertainty from GMW to the irrigators.

### 3 Data and methods

This paper is based on an analysis of the entitlement register as of 30 June 2004, as well as the trading registers for the first thirteen years of water trading within the GMID. Increases in water trading based on volume traded have previously been reported in papers such as [1, 2] but an analysis of the extend to which farm businesses have adopted water trading has not previously been carried out. To facilitate the most meaningful analysis, water entitlements were first consolidated into farm businesses. This was done by sorting the entitlement register by surname and address, and then consolidating all entitlements in the same ownership into one farm business. This process reduced the original number of 17,125 service numbers to 14,384 farm businesses. Next, farm businesses without a tradable water entitlement were eliminated reducing the number of farm businesses to 10,011. Trading registers were then merged with the entitlement register to analyze the trading pattern of each farm business for each of the thirteen years.

### 4 The uptake of trade over the last 13 years

This section analyses how big a proportion of farm businesses was active in water markets during each of the last 13 years. During the first three years only 3-4% of all farm businesses were selling or buying allocations (fig. 2). The use of the allocation market increased significantly to involve about 20% in 1994/95 when trade between district irrigators and river diverters, interstate trade in allocations and trade in 'sales' was introduced. The participation rate increased again in 1997/98 due to the low allocation that season and some further easing of trade restrictions (table 2). For the next three seasons, when allocations within the Goulburn System only reached 100% and opening allocations were very low, the participation rate remained steady at about 15%. During the following two seasons the participation rate increased sharply as the drought continued and the allocation in the Goulburn System was reduced to 57% and 129% in the Murray System in 2002/03 and to 100% in the Murray System in 2003/04. It can be noted that the new Water Exchange was in place from 1998/99, ready to deal with the substantial increase in trading activity.

Until 1998/99 approximately the same proportion of farm businesses participated in buying and selling allocations. Since then, more farm businesses have been involved in selling than buying allocations. During the most water scarce season of 2002/03 almost 45% of all farm businesses sold while only about 28% bought allocations. During 2003/04 the proportion selling fell back to 35% while the proportion buying continued to increase to 30%. The sharper increase in the proportion of selling farm businesses is caused by at least three factors: 1) the introduction of interstate trade in allocations; 2) the start of trading



into Sunraysia; and 3) the change to allocation announcements introduced in 1998/99. The last change has caused some irrigators to buy water early in the season when opening allocations are low. If allocations then increased more than expected they ended up with excess allocations which they then sold. This trading pattern is also reflected in the increase in the number of farm businesses which have both bought and sold allocations during the season (note that the farm businesses which have both bought and sold allocations during the seasons are also included in the graphs for buying and selling).

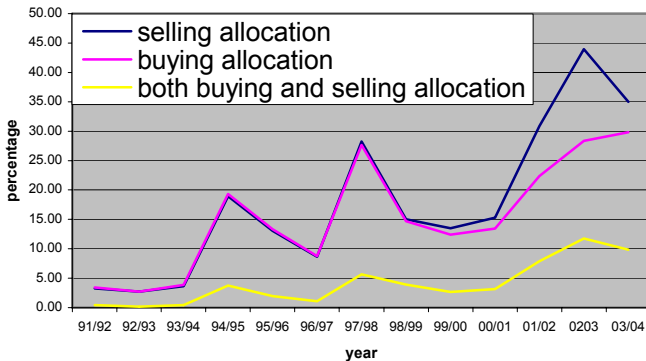


Figure 2: Percentage of farm businesses buying and selling allocations.

Figure 3 shows that the percentage of farm businesses in the market for entitlements increased from an initial 0.5% to between 1% and 1.5% buying and selling entitlements in 1994/95 when trade between river diverters and district irrigators were made possible and district irrigators purchased unused diversion entitlements at low prices [3]. Involvements in trade in entitlements increased further during 1996/97 and 1997/98 to just under 2% as a consequence of the easing of trade restrictions within both the Murray and the Goulburn Systems, the introduction of interstate trade in entitlements, and the commencement of downstream trade to the expanding wine industry. Since 1997/98 more farm businesses have been selling than buying, as a lot of water was sold to the Sunraysia region where the expansion in the wine industry was driving prices up (the buyers in this situation were located outside the GMID and therefore not included in figure 3). As the boom in the wine industry slowed, trade in entitlements declined again during the following years. As the drought intensified after 2000/01 the participation rate increased to 2.6% selling and fewer than 2% buying entitlements. This period also saw a substantial increase in allocation prices, many irrigators therefore felt that it was too uncertain and expensive to buy allocations and therefore increased their entitlement. At least part of the high level of selling has been caused by farm businesses within the GMID being more or less squeezed out of business due to increased water scarcity and high water prices as well as subsidies offered to exit the dairy industry.

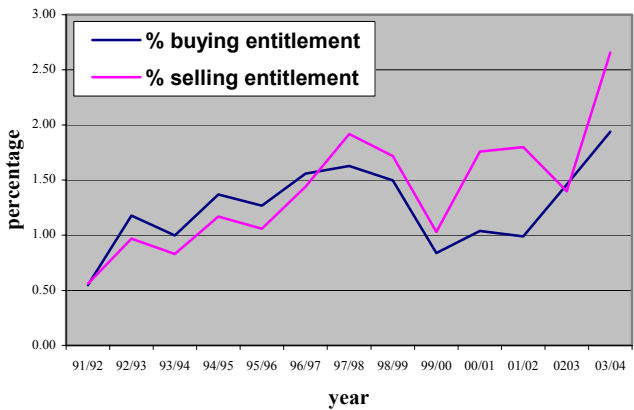


Figure 3: Percentage of farm businesses buying and selling entitlements.

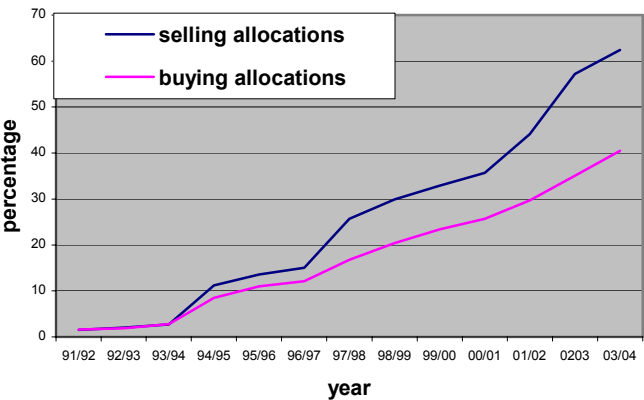


Figure 4: Accumulated percentage of farm businesses that have traded in allocations.

5 Market adoption within the GMID

This section analyses how new farm businesses have entered the market during the thirteen year period. Figure 4 shows the accumulated participation rate; that is, at the end of each season what percentage of farm businesses had then bought or sold allocations. The figure shows the same jumps in market participation in 1994/95, 1997/98 and 2002/03 as discussed above. It can be noted that the jumps are most significant among farm businesses entering the market to sell allocations and this gap has continued to grow since 1997/98. This pattern is likely to be caused by a number of factors including:





- An increasing number of smaller entitlement holders are selling to a few buyers using a number of small purchases to satisfy their needs. This is especially likely to be the case in 1994/95 when more private diverters entered the market, as they have smaller entitlements (table 1);
- very high allocation prices during 2002/03 made it worthwhile for smaller entitlement holders to sell their low volume of allocations;
- the start of downstream trade into Sunraysia in 1997/98 caused many farm businesses to sell water into this area. In such trades the buyers are outside the GMID and therefore not included in figure 4;
- The start of the Exchange in 1998/99 facilitating easy and cheap transfers encouraging smaller entitlement holder to trade; and,
- the change to allocations policy 1998 as previously discussed.

The increase in the participation rate in buying allocations has been consistently increasing as a result of a growing awareness of the benefits of buying and the increased need to buy water to keep the business going, during drought and policy induced scarcity.

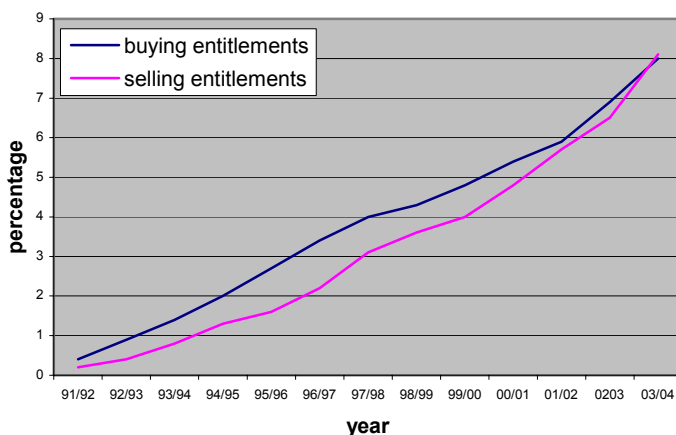


Figure 5: Accumulated percentage of farm businesses that have traded in entitlements.

Figure 5 shows the increase in the participation rate in the market for entitlements. The increase in farm businesses buying entitlements during the early years was higher than for selling entitlements. However by the end of the period the same proportion of 8% of farm businesses had bought and sold water entitlements. This development is caused by the fact that some early sellers of water entitlements sold all their water and therefore did not have any entitlement as of 30 June 2004 and therefore are not included in figure 4. That the market participation rate for selling entitlements by 2004 still approached 8%, as for buyers, is caused by the fact that many sellers since 1997 have sold water to the Sunraysia region.

## 6 Variation in market adoption

This section analysis the variation in adoption of water trading across the GMID. Figure 6 shows the proportion of farm businesses that participated in any kind of water trading each year within the different categories. The figure shows that until 2002/03 the participation rate was generally much higher within the Goulburn System than within the Murray System because of the higher level of allocations within the latter system (table 2). Figure 6 shows that:

- within the Goulburn System the participation rate was initially much higher within the western part with large segments of poor and saline soils as well as high levels of water use for grazing and mixed farming. This provided opportunities for mutually beneficial tradeoffs, when these farm businesses traded with higher value users on more productive soils predominantly within the eastern part; something that was made possible in 1995. The participation rate within the eastern part slowly reached the same level by 2000/01 driven by increased scarcity rather than potential tradeoffs;

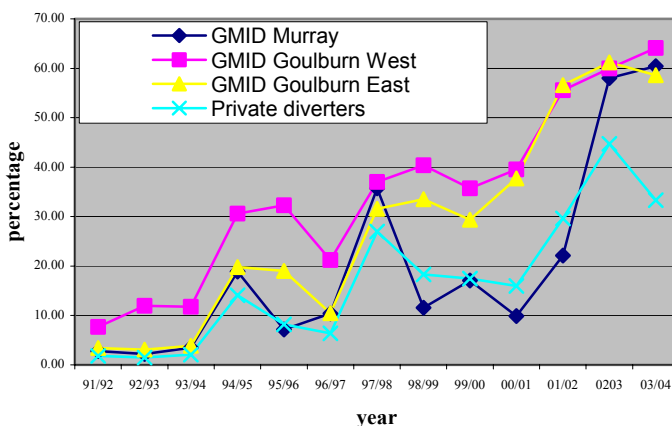


Figure 6: Percentage of farm businesses trading annually.

- the participation rate within the Murray System shows clear evidence of the impact of water scarcity. When allocations are at 200% or more, the level of market activity is markedly lower within this system. However, when the allocation drops down to 130% or 100% the activity level is similar to that within the Goulburn System. This is clearly evident during the seasons of 1997/98, 2002/03 and 2003/04 (table 2). It can also be noted that the participation rate during 2002/03 is almost the same within the two systems despite the fact that the allocation in the Goulburn System was 57% compared to 129% within the Murray System. This suggests that the preceding five year period of 100% allocations in the Goulburn System has caused some farm businesses to make long-term adjustments to reduce their need for seasonal trading while many farm businesses in the Murray System

have not been forced to do so. Reflecting this, when allocations in the Murray System dropped to 100% for the first time during 2003/04 the participation rate within that system was higher than within the eastern part of the Goulburn System; and,

- private diverters trade far less than district irrigators but with peaks in 1994/95, 1997/98 and 2002/03. The removal of trading restrictions between district irrigators and river diverters caused the first peak, the start of downstream trade into the Sunraysia region and low allocations during 1997/98 caused the second peak, while the third peak was caused by very high water prices during 2002/03 encouraging the smaller entitlement holder to sell. The lower participation rate among river diverters is also likely to be caused by the smaller entitlements held by these irrigators (table 1) and therefore a lower potential gain from trade. Relating entitlement size to market participation show a direct relationship between entitlement size and market activity. During 2002/03, 80% of all farm businesses with more than 300 ML of entitlement traded compared to only 20% of those with 10 ML or less [4].

Figure 7 shows the accumulated participation rate – that is the proportion of farm businesses that had participated in any kind of water trading at the end of each irrigation season since 1991. It can be seen that:

- the initial increase in the uptake of trade was relatively slow, with very few new farm businesses entering the market during the second and third year except within the western part of the Goulburn System. During this period irrigators slowly became familiar with trading, and high allocation levels reduced the need for trading;
- there was a high number of new entrants into the market during 1994/95 despite continued high allocations, as river diverters sold unused water following the introduction of trade between river diverters and district irrigators in 1994;

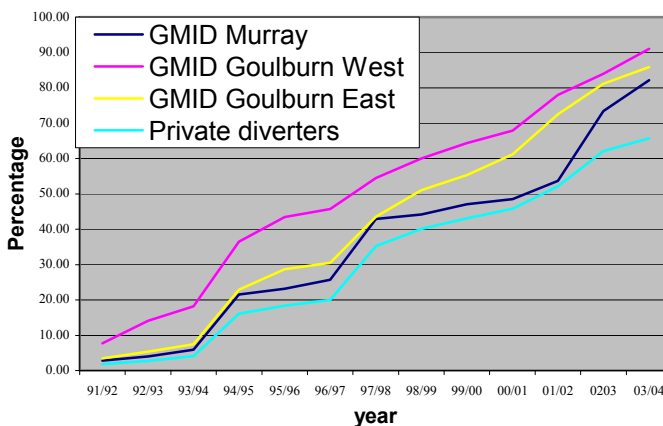


Figure 7: Accumulated % of farm businesses which have traded in water.

- the Goulburn System again saw a jump in new entrants in 1995/96 driven by a number of factors: 1) allocations dropped to 150%; 2) spatial restrictions on trade were eased; and 3) trade in sales water and interstate trade in allocations was introduced;
- the Murray System did not see many new farm businesses entering the market during the 1995 to 1997 period as allocations remained at 200% (table 2);
- all districts experienced a significant increase in new entrants during 1997/98 as allocation levels dropped to 120% and 130% respectively (table 2) and trade into Sunraysia started to take effect;
- within the Murray System the rate of new traders then slowed down again during the next four seasons as allocations returned to 200%;
- within both parts of the Goulburn System the rate of new entrants continued to increase as allocations declined to 100% and stayed there for the four seasons;
- the participation rate during this period increased sharply in the eastern part of the Goulburn System where new entrants were driven more by scarcity than the potential for beneficial tradeoffs, which caused early entrants in the western part;
- during this period the gap in the accumulated participation rate within the two parts narrowed; and,
- new entrants flooded into the market in the Murray System during 2002/03 and 2003/04 when allocations there declined to 129% and 100% respectively (table 2). The participation rate was then close to the levels within the Goulburn System with 82-92% of farm businesses having some market experience.

## 7 Conclusions

This paper has analyzed farm businesses use and adoption of water markets within the Goulburn-Murray Irrigation District in Northern Victoria, Australia during the first 13 years of water trading. The use of water markets was first adopted within the part of the district with the largest potential tradeoffs between high and low value producers and between irrigators with productive and unproductive soils. The adoption of water trading within the other parts of the GMID has been driven by increased scarcity induced both by drought and policy changes and made possible by successive easing of trading restrictions and the emergence of a water exchange. By 2004 about 85% of all farm businesses have had some exposure to water markets and during 2003/04, 60% of all farm businesses were trading in water. Larger irrigators have been far more active than small irrigators, with as many as 80% of the larger irrigators trading compared to 20% of the smallest irrigators.

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