The Australian Journal of Agricultural and Resource Economics, 50, pp. 425–435

Repurchase of renewal rights: a policy option for the National Water Initiative*

John Quiggin†

Management of the Murray–Darling river system involves a large number of users with imprecisely defined rights, and an aggregate rate of resource use that is environmentally unsustainable. One possible policy response is to make formal or informal contracts with users, under which users receive current benefits in return for a commitment to forgo usage rights in future. In this paper, this issue is explored with specific reference to the possibility of repurchasing the renewal rights for irrigation licenses.

Key words: National Water Initiative

In many resource management problems, the starting point is one involving a large number of users with imprecisely defined rights, and an aggregate rate of resource use that is environmentally unsustainable. The situation of the Murray–Darling Basin in the late 1980s fitted this description closely. Existing water allocations accounted for close to 100 per cent of average annual flows, and prevailing policies gave existing and potential users an expectation of increased usage rights in the future. Because of the variability of annual flows in the Murray–Darling Basin, which is greater than that of any other major river system in the world, it is possible to allocate more than 100 per cent of the average annual flow, and in some catchments this has been done.

One possible policy response, taking account of these characteristics of the problem, is to make formal or informal contracts with users, under which users receive current benefits in return for a commitment to forgo usage rights in the future. If users have high discount rates, this response may permit a substantial reduction in use over time at relatively low cost.

The current situation in the Murray–Darling Basin provides an opportunity for the adoption of such an approach. Most current licenses have been issued for a fixed term, normally 10 years in the case of New South Wales. There is an expectation of renewal, but there remains the possibility of changes in conditions, or even of withdrawal of rights, at the end of the term.

* This research was supported by an Australian Research Council Federation Fellowship. I thank Nancy Wallace and two anonymous referees for helpful comments and criticism.

† John Quiggin is an ARC Federation Fellow at the University of Queensland, Brisbane, Queensland, Australia.

doi: 10.1111/j.1467-8489.2006.00342.x

The 10-year period is also significant in relation to the possibility of changes in rights. Under the agreement on the National Water Initiative announced at the 2004 meeting of the Council of Australian Governments (CoAG), irrigators bear the risk of reductions in water allocations associated with new scientific knowledge until 2014. After that, risk is shared, with irrigators bearing the first 3 per cent and governments the rest. Thus, there is a possibility that the allocations associated with existing rights due for renewal around 2014 will be reduced before this date.

It seems likely that at least some users would be willing to forgo the prospect of renewal of their rights in return for a current payment, on terms that would yield improvements in sustainability at lower cost than the alternative of acquiring current rights at market prices.

The object of the present paper is to consider the desirability and practicality of the repurchase of renewal rights.

1. Background

Quiggin (2001) presented a summary of developments in policy for management of the Murray–Darling Basin from Federation to the late 1990s. This period can be divided into two phases, adopting the classification proposed by Randall (1981). In the expansionary phase, from the beginning of irrigated agriculture until the late 1980s, the main focus was on exploiting the resources of the system to promote the development of intensive agriculture. Governments were willing to support irrigation investments even when rates of return were low or negative.

Environmental problems and competition for water use became evident during the 1970s and acute during the 1980s, signalling the arrival of the mature phase in which the marginal social cost of water use is high and increasing over time. As Randall notes, when the expansionary phase reaches its inevitable end, and a mature water economy emerges, the problem of managing the resource is complicated by the persistence of policies inherited from the expansionary phase.

The most serious problems have arisen with attempts to create a market in water rights, following the imposition of a limit on aggregate extractions, referred to as the Cap, in 1995. The Cap was the first step in the development of a comprehensive policy response, referred to as the Living Murray Initiative (Murray–Darling Basin Commission 2003).

Under the Cap, it was agreed that the total allocation of water from the Murray–Darling Basin would not increase above the level prevailing in 1994. In the future, any new allocation to one user would have to be matched by a reduction for some other user. The need for water allocations to be transferred between users naturally raised the issue of trade.

The central idea of creating a market for trade in water rights is that rights would be reallocated from low-value uses such as pasture to high-value uses such as fruit and vegetables. Although this reallocation would not, in itself, do anything for the environment, it would reduce the cost and the social and

economic dislocation associated with reductions in the aggregate allocation of water.

It rapidly became apparent that this appealing idea was an oversimplification of the problem. Water is not a homogeneous commodity. Water in one place, and at one time is not a good substitute for water in another place or at another time. Because it is heavy and bulky, moving water from one place to another or storing it over time is difficult and expensive – this is why irrigation is expensive.

Water is a complex commodity. The structure of rights created by a century of water management is even more so. At the time of the 1994 meeting of the CoAG, few or no water users possessed property rights comparable to titles to land. The closest approximation was a license to take water, typically attached to a particular piece of land. On the other hand, a great many existing and potential users had expectations that water would be available to them.

As a result, the first problem with water trading was to determine who had water rights. An unanticipated difficulty arose with the emergence of 'sleepers' and 'dozers'. These were landholders who had water licenses attached to their land, but had never used them (sleepers) or had ceased to use them (dozers). As soon as water became a tradable commodity, the licenses held by such sleepers became a tradable commodity. As extractions from the Murray–Darling Basin were already at or near 100 per cent of natural flows in 1994, it was not possible to allow both the allocation of water to 'sleepers' and 'dozers' and the continuation of existing allocations to users who did not possess guaranteed rights. With some exceptions, the outcome was that users who had been receiving water under various provisions, but who had no specific entitlement, did not receive tradable rights, whereas sleepers' rights were upheld.

Policies for the management of the Murray–Darling were developed further at the 2003 CoAG meeting, which produced an announcement (but not a detailed specification) of a set of policy proposals referred to as the National Water Initiative (Council of Australian Governments 2003).

Two major principles were announced. The first was that, in the future, water allocations should be stated as shares of available water, rather than as specific volumes. This approach deals with fluctuations in water availability by sharing the total amount available among users in proportion to their share. It raises the question of whether it will continue to be possible, as at present, to distinguish between high-security and low-security rights. This problem will no doubt be addressed in the future.

The second principle concerned an approach to the sharing of risk arising from changes in the aggregate availability of water. Under this principle, the risk of changes in water availability due to new knowledge about the hydrological capacity of the system will be borne by users. The risk of reductions in water availability arising from changes in public policy, such as changes in environmental policy, will be borne by the public, and water users will receive compensation for such reductions.

The principles of the National Water Initiative were elaborated in more detail in a statement issued by the 2004 CoAG meeting (Council of Australian Governments 2004). The Communique specified a framework that assigns the risk of future reductions in water availability arising from (i) natural events such as climate change, drought or bushfire; (ii) *bona fide* improvements in knowledge about water systems' capacity to sustain particular extraction levels; and (iii) changes in government policy.

The most important aspect of the framework, for the purposes of the present paper, is the fact that rights may be significantly modified, in the light of new evidence about system capacity, until 2014, after which rights are substantially secure. Around the same time, a substantial proportion of licenses will be due for renewal.

1.1 The scientific review panel

A recent scientific survey undertaken as part of the Living Murray Initiative looked at options for restoring environmental flows (Jones *et al.* 2002). Average annual flows into the system are around 10 000 gigalitres (GL), and under current policies, almost all of this flow is allocated to extractive uses, primarily irrigation. (For comparison, Sydney uses around 650 GL each year.) Three options for restoring environmental flows were considered, involving flows of 350, 750, and 1500 GL. The scientific panel concluded that an environmental flow of 1500 GL was needed to achieve even moderate ecological improvements.

This is not a surprising outcome. Past experience, such as that surrounding the Snowy Flows agreement (restoring water flow to the Snowy River) suggests that somewhere between 15 and 30 per cent of natural flows is needed if a river system is to maintain its environmental health. Having been offered a range of choices from 3 to 15 per cent, the scientific panel naturally chose the figure at the top of the range.

But future reviews are likely to conclude that 1500 GL is not enough. To achieve a genuinely satisfactory environmental outcome, a natural flow of 3000 GL is probably needed. Looked at another way, 3000 GL per year is the amount by which the demands of existing users and the needs of the environment exceed the sustainable volume of water supplied by the Murray–Darling river system.

Considered in this light, the policy principles announced in the Living Murray Initiative raise as many questions as they resolve. Existing public policy calls for environmentally sustainable use, so it could be argued that the environmental flow of 1500 GL called for by the scientific review panel does not involve a change of policy. This does not seem likely to be an argument that will commend itself to irrigators. Even more acute difficulties are likely to arise if reductions in aggregate water use of more than 1500 GL are sought in the future.

However, as these issues are resolved, it seems likely that the achievement of a sustainable outcome will require the acquisition of water rights from irrigators on a substantial scale.

2. Policy options

As was noted in the introduction, the starting point for reforms to the management of the Murray–Darling Basin is one involving a large number of users with imprecisely defined rights, and an aggregate rate of resource use that is environmentally unsustainable.

In a standard property rights analysis, the response to a problem of this kind is straightforward. After the socially optimal level of use has been determined, tradable resource use rights equal, in aggregate, to the optimal level should be created and allocated. In the absence of transactions costs, it does not matter whether governments achieve this goal by withdrawing existing licences to the extent that the aggregate usage level exceeds the social optimum, then making the remaining rights legally enforceable and tradable property rights, or by making all existing licences legally enforceable and tradable and then repurchasing rights to achieve the socially optimal level. Moreover, if new knowledge implies a need for a reduction in the aggregate level of resource use rights, these can be purchased from users. Issues such as the distribution of rights and the required payment, if any, are seen as purely distributional, and therefore amenable to resolution through lump-sum compensation.

In reality, there are problems with each of the simple alternatives, namely, terminating all existing licenses at expiry and starting afresh or converting all existing licenses into secure property rights. As discussed above, it is evident that the optimal volume of rights will be greater than zero, but less than the total implied by existing licences and entitlements of various kinds. Hence, either of the simple alternatives will yield a starting point where the aggregate volume of water use implied by existing rights will be far from the socially optimal level.

Consider first the option of cancelling existing licenses at expiry, and auctioning newly created rights. Obviously, this involves a substantial redistribution of wealth away from existing users, who have a reasonable, if imprecise, expectation that their current licenses possess a renewal option. Almost certainly, such a redistribution would involve a reduction in social welfare, even with no change in the aggregate volume of rights. On the other hand, if newly created rights are distributed freely, or at below-market prices, to some class of existing users, the process creates incentives for rent-seeking lobbying and so on.

The converse problem arises with the option of enhancing the status of existing licenses and other attenuated property rights. The option of converting all existing licenses involves the creation of an excessive volume of rights. In the absence of lump-sum sources of revenue, repurchase of these rights will involve welfare losses. On the other hand, the option of terminating some categories of licences while enhancing others has obvious distributional implications and is likely to imply substantial incentives for rent-seeking behavior, as marginal changes in the classification of particular rights can have substantial costs or benefits for their holders.

All of these problems have already been observed in the first round of water market reforms during the 1990s. The policy approach adopted in the

1990s may be described as one of making existing licences more akin to standard property rights, while repudiating less formal claims derived from historical usage, promises and expectations. The introduction of tradable water rights created windfall gains for holders of sleeper and dozer rights, and led to an expansion in the effective volume of water rights while imposing costs on water users with less secure rights.

These difficulties are exacerbated by information problems. Our understanding of the hydrology of the Murray–Darling system, of the possible implications of climate change, and of the economic implications of alternative policy options is incomplete, but is likely to improve over time. Hence, there are substantial potential gains from flexibility in the design of property rights. As noted by Randall (1974), whenever transactions costs are significant, there is an inevitable trade-off between security and flexibility in the structure of property rights. One way of stating the key insight of Coase (1960) is to observe that this trade-off is less favourable, the further is the initial allocation of rights from the socially optimal allocation.

The importance of transactions costs in determining the outcomes of trade in water markets has become increasingly evident. Challen (2000) provides a discussion of the issues.

2.1 Repurchase of renewal rights

As noted above, one possible policy response arises from the fact that most current licences are for a fixed term with an expectation of renewal, but with the possibility of changes in conditions, or even of withdrawal of rights, at, or near, the end of the term.

Examination of market prices suggests that some water users would be willing to sell their renewal rights relatively cheaply. Permanent water trades recorded by Murray Irrigation Limited have typically taken place at prices close to $A400 per megalitre (ML), whereas temporary trades, which take effect only for a single year, have taken place at prices between $A60/ML and $A80/ML. If these prices are representative[1], they imply some combination of high discount rates and a low value for the renewal option associated with 'permanent' rights. For any such combination, the implied present value of the renewal right is small.

This point is illustrated in Table 1, where, for illustrative convenience, it is assumed that the price of a 'permanent' right is $A400/ML and the value of an annual allocation is $A80/ML. Thus, if renewal is treated as automatic, so that a permanent right is treated as equivalent to a perpetual flow valued at $A80/ML, the implied annual discount rate is 20 per cent.[2] As renewal is

[1] If temporary trades take place primarily in periods of water shortages (surpluses), the price will be greater than (less than) the average value of the associated right.

[2] Because the payments are annual, the implied internal rate of return is slightly less than 20 per cent.

Table 1 Estimated present value of renewal rights

Renewal probability	1	0.8	0.6	0.5	0.25	0
Implied discount rate (%)	19.2	18.3	17.4	16.9	15.4	13.7
Present Value of renewal right ($/ML)	69.1	59.5	48.4	42.1	23.8	0.0

Notes: The implied discount rate is the internal rate of return r that sets $V = \sum_{t=t}^{\infty}(1 + r)^{-t} vp_t$
where: V is the price of a permanent water right ($400);
v is the price of a temporary trade ($80);
$p_t = 1$ for $1 \leq t \leq 10$ and for $t > 10$, p_t is the renewal probability; and the Present Value is the value, at $t = 0$, of the stream vp_t beginning at $t = 10$, discounted at the rate r.

assumed automatic, the future value of the right at the renewal date 10 years in the future is $A400/ML. Discounting over 10 years at a rate of 20 per cent yields a present value of $A69. Even lower present values arise if the future value of the renewal option is lower than the present value of a permanent right. It should be noted, however, that the markets are relatively thin, particularly in relation to long-term trades, and that there are constraints on trades between catchments.

There are a number of possible explanations of the implied low value of renewal rights, including possible market failures and imperfect rationality on the part of market participants. However, assuming that the private rate of discount is closer to 10 per cent than to 20 per cent, it seems reasonable to suppose that, at least in part, the low valuation reflects uncertainty surrounding the nature of rights that will emerge as a result of the current policy debate. As has already been argued, there is no simple method of resolving this uncertainty in the short term that does not involve substantial social costs.

If the values estimated in Table 1 are accurate, a small investment in the repurchase of renewal rights could significantly increase the flexibility of policy options in 10 years' time. Assuming that the values of future natural flows can be converted to equivalent current natural flows by discounting at the real bond rate[3], such a proposal would yield an apparent Pareto-improvement relative to the immediate purchase of permanent rights. The present social value of a future reduction in water use would exceed the private present value of the associated renewal right. However, it has frequently been the case that apparent Pareto-improvements are illusory on closer inspection. It is therefore desirable to consider this issue more closely.

2.2 Discounting and welfare

The idea that high individual discount rates may lead to excessive rates of environmental degradation has been discussed extensively for many years going back at least as far as Marglin (1963). Similarly, the view that pollution

[3] The case for using the real bond rate in evaluation of public investments has been debated at length. A recent restatement, drawing on the literature on the 'equity premium', is presented by Grant and Quiggin (2003).

problems may be addressed by paying polluters to forgo explicit or implicit rights to pollute may be traced back to Coase (1960).

Now, consider a policy interaction between these two ideas. More specifically, consider the option of making a present payment to a polluter with a high discount rate in return for a commitment to cede pollution rights at some future date. The benefit–cost analysis for such a proposal is simple, and, at first sight, compelling.

Consider a simple example. Suppose that the social rate of discount is 4 per cent and a polluter with a discount rate of 10 per cent has a right to pollute. Exercise of the right will produce private benefits and social costs, both equal to $A100, and can take place in 10 years' time. Then the present value of the pollution right to the polluter is about $A37, whereas the present value of the social cost is about $A75. Hence, a policy that pays the polluter his private valuation now in return for ceding the pollution right has a benefit–cost ratio of 2.

There are, however, obvious difficulties. In terms of the arithmetic, it is apparent that the example would work equally well if the private benefits were $A120, implying that the cessation of the pollution right would reduce future welfare. This appears to imply some form of policy inconsistency. In terms of the standard market failure framework, it is not clear what market failure is being corrected, and whether the analysis implies the existence of unexploited arbitrage opportunities.

2.3 Welfare analysis

In considering the validity of a proposition yielding an apparent Pareto-improvement, a number of checks are appropriate. One such check is suggested by the First Fundamental Theorem of Welfare Economics. As a competitive market equilibrium is Pareto-optimal under the conditions of the theorem, any feasible Pareto-improvement must reduce the welfare loss caused by one or more missing markets. Hence, it is necessary to identify the missing market in question.

Second, it is necessary to consider whether an alternative policy could yield a superior outcome. In particular, it is necessary to examine whether it is feasible to create the missing markets, the absence of which justifies the policy.

Finally, it is useful to consider whether there exists a *reductio ad absurdum* critique. One critique of this kind arises if the conditions required for the policy in question to yield a Pareto-improvement also imply that other policies would be welfare improving when there are strong grounds to suppose that such policies would actually reduce welfare. A second form of *reductio ad absurdum* critique arises if the policy gives rise to unbounded (or large) arbitrage opportunities.

On the first point, as has already been noted, the capacity of the policy to generate welfare improvement depends on the absence of a market for renewal rights. The difficulties of specifying rights precisely appear to preclude

the creation of such a market. However, they do not appear to prevent governments from offering to repurchase renewal rights from the holders of such rights.

However, this market failure is necessary but not sufficient for welfare improvement. In addition, it is necessary that there should exist one or more capital market failures leading to the existence of a difference between the discount rate facing farmers and that facing governments.

To formalise these claims, consider the case where there exists a market for renewal rights. In this case, any welfare benefits achieved through the policy under consideration could equally be achieved by making loans to farmers at a rate lying between the public and private discount rates. As such a policy would normally be welfare reducing in the absence of a solution to the capital market failures that generated the difference in interest rates, a *reductio ad absurdum* critique applies.

Now, consider the case where there is no difference in discount rates. In this case, there is no benefit associated with repurchasing rights now rather than immediately prior to the resolution of uncertainty regarding renewal. If, as seems likely, advance repurchase involves additional transactions costs, it would reduce welfare relative to the alternative of deferred repurchase.

These arguments are developed more formally in an Appendix, available from the author.

3. Implementation issues

As renewal rights are not specified exactly at present, the question of how they might legally be relinquished is problematic. One possibility would be to create a new class of 'terminating' rights, and offer payments to users who are willing to convert their existing rights to terminating rights. In formal terms, there is not much distinction between terminating rights with a duration of 10 years and the 1-year temporary licences that are currently traded.

Next, there is the question of credible commitment. Having accepted a cash payment in return for the relinquishment of renewal rights, some or all water users might seek to repudiate or renegotiate the agreement when their licences expired. The risk of such an outcome depends on a variety of factors, such as the capacity of water users to exert political pressure on governments. The fact that the proposal rests on individual agreements, entered voluntarily, tends to increase the credibility of users' commitments to relinquish rights.

Another possible point at which users might seek renegotiation arises when the details of renewal rights are specified. Users might argue that they were not properly informed about the rights they were relinquishing. The risk of dispute would increase if crucial details were not specified until close to, or even after, the renewal date. Thus, it would be preferable to specify the details of renewal rights well before the expiry of current rights.

Considering these issues, the most promising approach to implementation would be to experiment with one or more small-scale initiatives. A number of possible outcomes might arise.

First, irrigators might show little or no interest in participating in a market for rights in the relatively distant future, whatever its theoretical attractions. The absence of farmer interest has led to the demise of futures markets in a number of commodities, despite the apparent benefits of such markets for risk management, and the same problem might arise in relation to water rights.

Second, the anomalous relationship between short-term and long-term prices might disappear even with only a small intervention. This would suggest that the anomaly was the result of thin markets and that the problems of risk and uncertainty about future rights were not as severe as is commonly supposed. In this case, a standing offer of repurchase of renewal rights might help the performance of the market, yielding small but positive benefits.

Third, the offer of repurchase might create arbitrage opportunities for private agents not subject to the transactions costs which are required if a gap between permanent and temporary trade prices is to persist. At present, if any such arbitrage is taking place, it is on a very small scale, but, as the example of 'sleeper' rights suggests, changes in the nature and tradability of property rights can often have unexpected consequences, and arbitrage opportunities rarely go unexploited for long.

Finally, the most favorable case would be one in which there was a significant volume of trade, bringing temporary and permanent trade prices closer to equilibrium, but not eliminating the price discrepancy altogether. In this case, a general offer of repurchase of renewal rights might be expected to achieve both a reduction in the gap between the current volume of water rights and the sustainable volume and an improvement in the efficiency of markets for water rights.[4]

4. Concluding comments

The problems of the Murray–Darling Basin have developed over more than 100 years, and will not be resolved rapidly. In most cases, the adverse consequences of excessive water use have developed slowly over time and will continue to do so. By contrast, the costs of adjustment to lower levels of extractive water use are acute and immediate.

In these circumstances, there is a strong case for policies that take account of the difference between the discount rates applicable to public investments in sustainable management and those faced by water users. The option of purchasing renewal rights is one such policy.

[4] A referee observes that there is an 'implicit transactions costs argument that welfare would be improved if as 2014 approaches the government has just about the right amount of rights in hand to provide for flow requirements. In such a case, the chances of non-renewal would diminish and rights in private hands would become more secure as 2014 approaches. So, the proposed purchase of rights from willing sellers motivated mostly by uncertainty in these rights would actually make everyone else's rights more secure'.

References

Challen, R. (2000). *Institutions, Transaction Costs, and Environmental Policy: Institutional Reform for Water Resources*. Edward Elgar, Cheltenham, UK.

Coase, R. (1960). The problem of social cost, *Journal of Law and Economics* 3, 1–44.

Council of Australian Governments (2003). Communiqué, 29 August 2003. Available from URL: http://www.coag.gov.au/meetings/290803/index.html [accessed 17 August 2004].

Council of Australian Governments (2004). Communiqué, 25 June 2004. Available from URL: http://www.coag.gov.au/meetings/250604/ [accessed 17 August 2004].

Grant, S. and Quiggin, J. (2003). Public investment and the risk premium for equity, *Economica* 70, 1–18.

Jones G., Hillman T., Kingsford R., McMahon T., Walker K., Arthington A., Whittington J. and Cartwright S., (2002). *Independent Report of the Expert Reference Panel on Environmental Flows and Water Quality Requirements for the River Murray System*. Cooperative Research Centre for Freshwater Ecology. Report to the Murray–Darling Basin Ministerial Council, February.

Marglin, S. (1963). The social rate of discount and the optimal rate of investment, *Quarterly Journal of Economics* 77, 95–111.

Murray–Darling Basin Commission (2003). *The Living Murray*. Available from URL: http://www.thelivingmurray.mdbc.gov.au/content/index.phtml/itemId/3288 [accessed 17 August 2004].

Quiggin, J. (2001). Environmental economics and the Murray–Darling river system, *Australian Journal of Agricultural and Resource Economics* 45, 67–94.

Randall, A. (1974). Coasian externality theory in a policy context, *Natural Resources Journal* 14, 37–54.

Randall, A. (1981). Property entitlements and pricing policies for a maturing water economy, *Australian Journal of Agricultural Economics* 25, 195–220.