

Market-Based Tools for Environmental Management: Where do they fit and where to next?

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Abstract

Eighteen papers are presented in this volume relating to MBI theory, design and experience. In this paper we synthesise some of the key lessons that emerge from these papers and the discussion at the symposium in which they were presented. A key conclusion is that MBIs offer both great promises, but also potential pitfalls. Their promise can be achieved while avoiding many of the pitfalls by paying careful attention to MBI design focusing on: property rights; risk and who bears it; flexibility of action; equity implications; and, the evolution of instruments through time. Careful design is no panacea however, as there remain a number of areas of conceptual or practical design that are yet to be sufficiently addressed to provide guidance.

1. Introduction

The papers in this volume cover a wide range of topics relating to market-based (MBIs) and market-like instruments (MLIs). They include overviews of the Australian and International experience, Australian MBI case study examples, tools and methods for MBI design and application, and, important considerations in MBI application such as equity. Our goal in this paper is to draw some broad conclusions from the papers in this volume and from the plenary discussions at the symposium in which they were presented.

The focus of MBI development and implementation can be summarised by paraphrasing Chaudhri in this volume:

*How do we get the **right** intervention at the **right** location at the **least** cost, so as to facilitate optimal environmental management in a particular region?*

However, MBIs are only one tool out of a menu of policy options for achieving “optimal” environmental management, including no specific policy intervention. MBIs are policy interventions that encourage behavioural change through market signals. But not all MBIs are effective or desirable. Those that are effective and efficient are likely to encourage behavioural change that is:

- the intent of the policy rather than raising revenue from the instrument;
- embedded in instrument design (as opposed to bolted onto the end of a policy) therefore providing for compliance flexibility and incentives for innovation; and,
- achievable in practice thus allowing the gains from trade and potential cost-efficiencies to be accessed in heterogeneous communities.

In this paper we draw some broad conclusions from the papers and discussion at the 6th Annual AARES Symposium on Market-Based Tools for Environmental Management about designing effective and desirable MBI policy interventions. In the next section we identify some of the promise that MBIs show for achieving environmental management goals more effectively and efficiently than traditional methods, as well as some of the perils and pitfalls that await over-zealous or poorly considered applications. Some of the important design issues in MBIs are reflected on in the third section including types of MBIs, the necessary conceptual and institutional underpinnings, and the importance of information. Finally, we identify some of the conceptual and design frontiers in MBI development and application, particularly in Australia.

¹ The authors' affiliations are respectively: CSIRO Sustainable Ecosystems and CSIRO Land and Water. This paper draws on the presentation made by Mike Young at the 2003 AARES Symposium. The authors would like to acknowledge the assistance of Mandy Yialeloglou in preparing the paper.

2. Promises and pitfalls

Many claims have been made about the potential for MBIs to achieve environmental targets at low cost across Australia. Some of those made at the AARES symposium include:

- MBIs can make problems go away;
- reality is not a special case (meaning economic theory can be applied directly to real world problems);
- MBIs are conceptually simple and based on a “back to basics” approach; and,
- MBIs are guilt free, waste free & envy free.

Often these claims are made in conjunction with commentary about the paucity of government support that is forthcoming to achieve desired outcomes through other policy instruments. The implication is that MBIs are somehow a cure-all for environmental problems.

However, it is timely to review this assessment of MBIs in view of the pitfalls of poor or inappropriate MBI design and application. These pitfalls are reflected in concerns about MBIs including:

- the potential impact of market failures within MBIs due to few trades or the potential for market dominance by individual players;
- the risks in designing MBIs and whether they will achieve target outcomes;
- the difficulty and complexity of property rights issues within MBIs, particularly where the interaction with existing rights may cause perverse outcomes (for example water market impacts on sleeper rights); and,
- concerns about the equity impacts of competition in MBIs.

In discussing the promises and pitfalls of MBIs it is worthwhile to revisit the definition of market-based instruments as ‘policy tools that encourage behaviour through market signals rather than through explicit directives.’ The implication is that MBIs are reliant on competition in a market place in order to efficiently achieve the desired outcome. Along with this reliance on competition there are a number of implied, but not necessarily required, assumptions about the nature of the instrument. For example, MBIs are commonly assumed to involve lots of sellers and buyers, regular transactions (‘sales every week’) and lots of information being available. However, MBI’s, and the form of the competition that is invoked, take many forms including (Schlizzi this volume):

- double-sided MBIs such as tradable permits;
- single-sided MBIs such as conservation auctions; and,
- no-sided MBIs such as taxes and flat rate subsidies.

Of these forms only double-sided MBIs show full resemblance to the common perception.

The reliance of MBIs on competition is the source of both the promise and the pitfalls. Competition is the source of the potential economic efficiencies and cost-effectiveness in achieving policy goals. The absence of competition, or misdirected competition, is the source of market failures and MBI pitfalls. Because of these attributes MBIs will tend to be most promising and effective where there is substantial conflict in resource use as a result of differing values in use. Alternatively, MBIs will tend to be most promising where there are substantial variations in compliance costs. This is because these cost differentials are revealed in the trades within markets. The reallocations that arise through the trades in markets are also one source of MBIs attractiveness to governments. The market performs the detailed allocative process without the information problem that faces government in trying to allocate resources.

Competitive markets for environmental outcomes do not arise spontaneously – a point that was emphasised by many presenters at the symposium. Rather, effective MBIs arise from good design processes that include a regulatory and enforcement framework. Hence, good government is required to create and support effective MBIs. The importance of strong design in creating effective MBIs has been recognised in the development and funding of the National Market Based Instrument Pilot Program under the National Action Plan for Salinity and Water Quality. This program is funding 11 MBI pilot projects that are shown in Table 2.1.

Table 2.1: Pilot MBIs funded under the National Action Plan for Salinity and Water Quality

| Market Title | Market Type | Region |
|---|-------------------------|--|
| Multiple outcome auction of land-use change | Auction | Goulburn Broken, VIC |
| Tradeable net recharge contracts in Coleambally Irrigation Area | Cap & Trade | Lachlan-Murrumbidgee, NSW |
| Farming Finance: Creating positive land-use change with a natural resource management leverage fund. | Revolving leverage fund | Lachlan-Murrumbidgee, NSW; South Coast, WA. |
| Auction for landscape recovery | Auction | Avon, WA |
| Cap & trade for salinity: Property rights and private abatement activities, a laboratory experiment market. | Cap & trade | Lower Murray, VIC/SA |
| Catchment Care – developing an auction process for biodiversity gains and water quality outcomes | Auction | Mt Lofty-Kangaroo Island, SA |
| Green off-sets for sustainable regional development | Offsets | Namoi-Gwydir/ Macquarie-Castlereagh/ Murray, NSW |
| Establishing east-west landscape corridors in the southern Desert Uplands | Auction | Burdekin-Fitzroy, QLD |
| Establishing the potential for off-set trading in the lower Fitzroy | Cap & trade | Burdekin-Fitzroy, QLD |
| Recharge credit trade | Baseline & credit | Avoca-Loddon-Campaspe, VIC |

Source: <http://www.napswq.gov.au/about/mbi/projects.html>

The importance of good design was also reflected in the comments of participants at the symposium about MBI development and application such as:

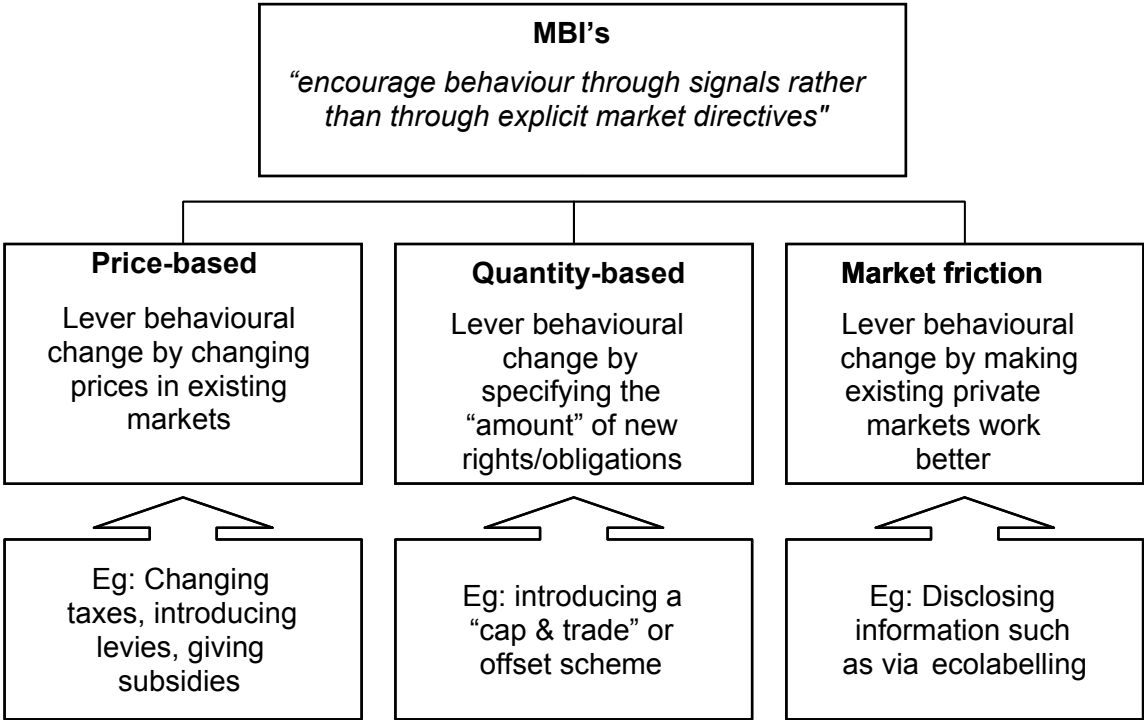
- thinking is cheap;
- don't rush (but also recognise the costs of moving too slowly),
- while MBIs offer promise they are not a panacea; and,
- even where policy tools are poorly considered we should seek to 'waste money wisely'.

That is, the most efficient and effective outcome should be designed given the constraints.

3. Designing market-based tools

Good instrument design is essential in obtaining the desired behavioural change. Instrument design is focused as much on avoiding MBI pitfalls as on achieving their promise. MBIs may be designed to change behaviour by changing prices, specifying quantity, or reducing friction in existing markets, as summarised in Figure 3.1. In theory both price-based and quantity-based approaches are equivalent, but in practice many factors influence the relative outcome including the relative uncertainties in the impact of different measures and relative design difficulties. In general price-based mechanisms provide more certainty as to the compliance costs of the MBI while quantity based-mechanisms provide more certainty as to the environmental outcome. The difficulty is that there are normally cost-benefit trade-offs in setting both price and quantity outcomes as noted by Bennett in this volume.

Figure 3.1: Types of Market-Based Instruments



There will also be considerations about the nature of the behavioural change that is desired. Is the instrument designed to push undesirable behaviour away or pull behaviour towards some specific action? For example, a cap and trade program on emissions pushes emitting behaviour away while a conservation auction pulls behaviour towards the conservation outcome. ‘Push’ changes will allow or encourage new behaviours to be discovered while ‘pull’ changes tend to require a behavioural action. These two drive very different innovation strategies. Pushing away from undesirable behaviour encourages broad innovation to find new ways of using resources while pulling behaviour towards a desired point encourages innovation that finds cheaper ways of reaching that point.

Whichever MBI is selected a number of critical design issues will arise with respect to property rights, equity considerations, distribution of risk, availability of key information, incorporating flexibility, and, the potential for MBIs to evolve given that they are designed within existing institutional and social constraints. In many cases these design issues are interrelated. For example, designing a market to incorporate information deficiencies may necessitate designing a market that is able to cope with evolving property rights in response to new information. In the remainder of this section we discuss each of these briefly in turn.

3.1 Property rights and MBIs

Property rights underpin MBIs because they specify a benefit (often termed the entitlement), who can access that benefit (the allocation), and any corresponding duties (or obligations) that access would entail. Property rights are a much-misunderstood concept because there are often different bundles of rights associated with differing ownership or property right statuses. For example, Ostrom and Schlager (1996) divide the benefits associated with various ownership statuses as shown in Table 3.1.

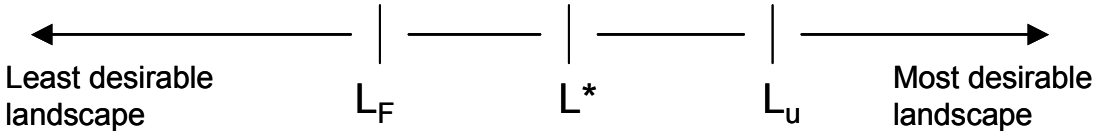
Table 3.1: Bundles of rights associated with ownership positions

| Right or Benefit | Ownership status | | | | |
|------------------|------------------|------------|----------|-----------------|--------------------|
| | Owner | Proprietor | Claimant | Authorised user | Authorised entrant |
| Access | X | X | X | X | X |
| Withdrawal | X | X | X | X | |
| Management | X | X | X | | |
| Exclusion | X | X | | | |
| Alienation | X | | | | |

Source: Ostrom and Schlager (1996, p. 133)

Of particular concern in the design of many environmental MBIs are the obligations that are associated with particular bundles of rights, often expressed as the ‘duty of care’ that is required in order to access part or all of the benefits available under the rights owned. The existing ‘duty of care’ effectively provides the baseline from which the MBI is intended to leverage behavioural change. That is, behaviour compliant with the ‘duty of care’ is expected regardless of the MBI. However, there is often much debate over where the duty of care lies, with different right or benefit holders seeing the most appropriate duty in differing places as shown in Figure 3.2 from Bromley (1997). In Figure 3.2 the actual ‘duty of care’ expected of farmers with respect to their landscape management is designated L^* . However, farmers may perceive the appropriate level as below this level (say L_F), while urban interests may consider that a higher level is appropriate (say L_U).

Figure 3.2: Potential distribution of perceptions with respect to property rights

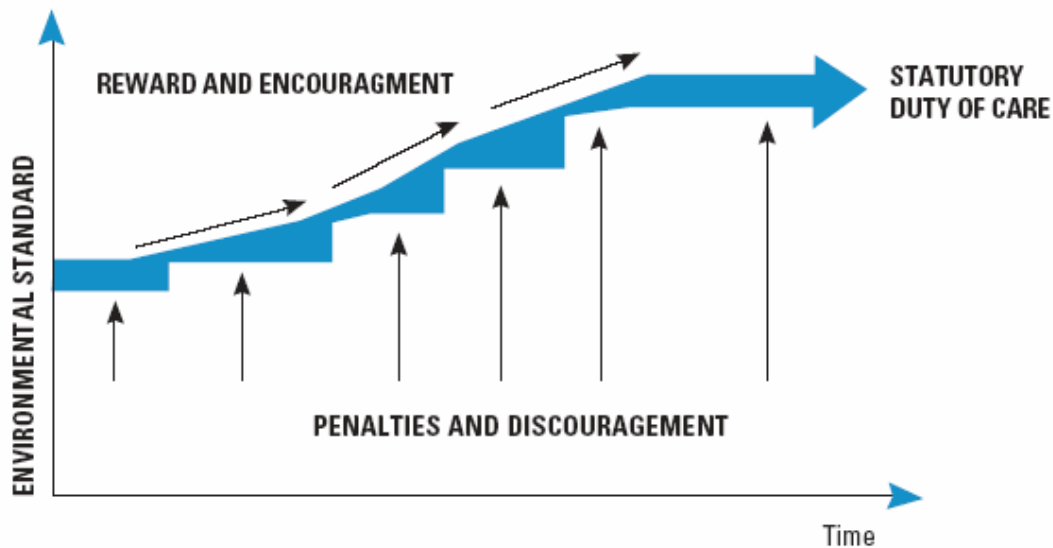


Source: Bromley 1997, p. 37.

A related concept is the role that MBIs play if the requisite ‘duty of care’ changes in response to changing community expectations.² Consider for example Figure 3.3. MBIs may be one effective mechanism for the ‘reward and encouragement’ supporting changes to the statutory duty of care.

² It should be noted that any unstated future changes in the requisite duty of care may increase the sovereign risk associated with MBIs and thus their relative effectiveness and efficiency.

Figure 3.3: Potential changes in ‘duty of care’ through time



Source: Young, Shi and Crosthwaite (2003, p. 16).

3.2 Equity considerations in MBI design

Equity is a multifaceted concept as discussed by Schilizzi in this volume. Depending on the context equity may refer to equality in access, treatment, outcome, or some amalgam of these and other attributes. However, MBIs are designed to increase efficiency in resource allocation and there is no reason to expect that the outcome will be equitable whatever the definition. Efficiency is essentially a distribution free concept. So why consider equity at all? Because considerations other than efficiency *are* taken into account when deciding whether to implement an MBI and what form it will take. As Stavins (2000) notes: ‘policy instruments that appear impeccable from the vantage point of research institutions, but consistently prove infeasible in real-world political institutions, can hardly be considered “optimal”.’ Or paraphrasing Hahn, Olmstead and Stavins (2003): both the efficiency and cost-effectiveness criteria may be hard to swallow when the distributional impacts of MBIs are highly skewed. Put simply, if equity forms part of the decision equation then it is part of the design equation as well.

So what can MBI design do to consider or incorporate equity? Many facets of equity are in fact automatically considered within the design process although it may not be stated as such. For example, equity of access is often considered against the costs of expanding the scope of the MBI. Similarly, equity of treatment within MBIs is often a fundamental principle. For example, small water licence holders are treated the same as large licence holders.

Equity of outcome is a more complex issue, whether it requires that MBI participants be no worse off than before or a more stringent condition. While economists have tended to indicate that equity of outcome should be dealt with through alternative mechanisms, the fundamental question of the usefulness of a MBI that is not adopted remains.

3.3 Risk, information and MBIs

Risk and information are discussed together because they are directly linked: the greater the information available the less the risk and uncertainty. This fundamental principle extends to all policy options and to all types of risk and uncertainty. MBIs are often perceived as risky because they are relatively new mechanisms about which many policy practitioners know relatively little. However, MBIs have a fundamental advantage over most other instruments when they are well designed because they are powerful in revealing information through the behaviour of participants in

the created market. MBIs can be termed information efficient because of the information revealed in the market processes.

The general conclusion about the risk efficiency of markets should be tempered somewhat by noting that most command and control regulatory schemes are negotiated outcomes that are low cost. The information that is revealed in the negotiation process is similar to that revealed in the market process and means that in some circumstances the negotiated regulatory outcome is at least as efficient as the market outcome. Furthermore, all instruments remain subject to risk and uncertainty. This risk can be moderated through careful design and testing in advance. However, the information revelation within markets can ease parts of the design burden and mean that while MBIs can perform poorly they will often perform better than an alternative instrument designed with similar information.

3.4 Incorporating flexibility

The incorporation of flexibility into MBI design is a crucial element in capturing widest possible range of gains from trade and encouraging future innovation. Designing to incorporate flexibility should particularly consider the degree of heterogeneity in the costs of pollution abatement or service production, and the spatial nature of the issue targeted.

Heterogeneity (or divergences) in the costs of alternative producers is essential to achieving the gains from trade that are necessary for MBIs to work well, and more importantly are a key condition for MBIs to outperform alternative instruments (Stavins 2000). In order to maximise the potential gains from trade a wide range of potential and actual producers should be included in the MBI. For example, inclusion of both point and non-point sources in the nutrient trading examples provided by Faeth (2000) is a key element in the extent of the available gains from trade. However, there is an important caveat: broadening the market may come at a cost, either in design terms or in transacting within the market. Specifically, the greater the degree to which the actions are substitutable will determine the degree to which they can be considered within alternative MBI designs.

While flexibility in the scope of actions included within MBIs is important to achieving the gains from trade, the spatial impacts of changes in actions should also be considered to ensure that localised “hot spots” or other perverse outcomes do not occur. As Stavins (2000) notes, the greater the degree of mixing or the greater the uniformity of impact, the more attractive a MBI will be. For example, if biodiversity is relatively uniform across a landscape then a more flexible MBI design may be used to capture the gains from trade across a broad area. However, if biodiversity is concentrated in specific parts of the landscape a more complex and less flexible mechanism may be required with potentially fewer gains from trade. However, the very variability of biodiversity across landscapes may reflect heterogeneity in costs and reflect the potential for an MBI to access gains from trade.

The flexibility offered by the design of certain MBIs in the face of other economic factors may also be a strong reason for their adoption over alternative options. For example, consider the impacts of a cap and trade permit system versus a tax system per Stavins (2000). Under a tax system the aggregate environmental target will change as the economy grows (total emissions grow) or due to the impacts of inflation (costs of unit tax fall as proportion of total costs). Conversely with technical innovation under a tax system the aggregate environmental outcome will improve. In each case the cap and trade system will maintain a set outcome.

3.5 Designing for future MBI evolution

MBIs are not static instruments and like all policy are likely to need modification in the future in order to continue to meet the needs of society. These modifications may be easier if the MBI is designed to evolve through time. There are at least three dimensions that MBIs may need to evolve within. As noted previously, considerations other than equity may mean that regulation evolves into a MBI through time rather than simply creating the MBI. Second, the baseline within MBIs may change through time. Finally, the desired mix of outcomes that the MBI impacts on may change, necessitating a different form of MBI or even multiple MBIs.

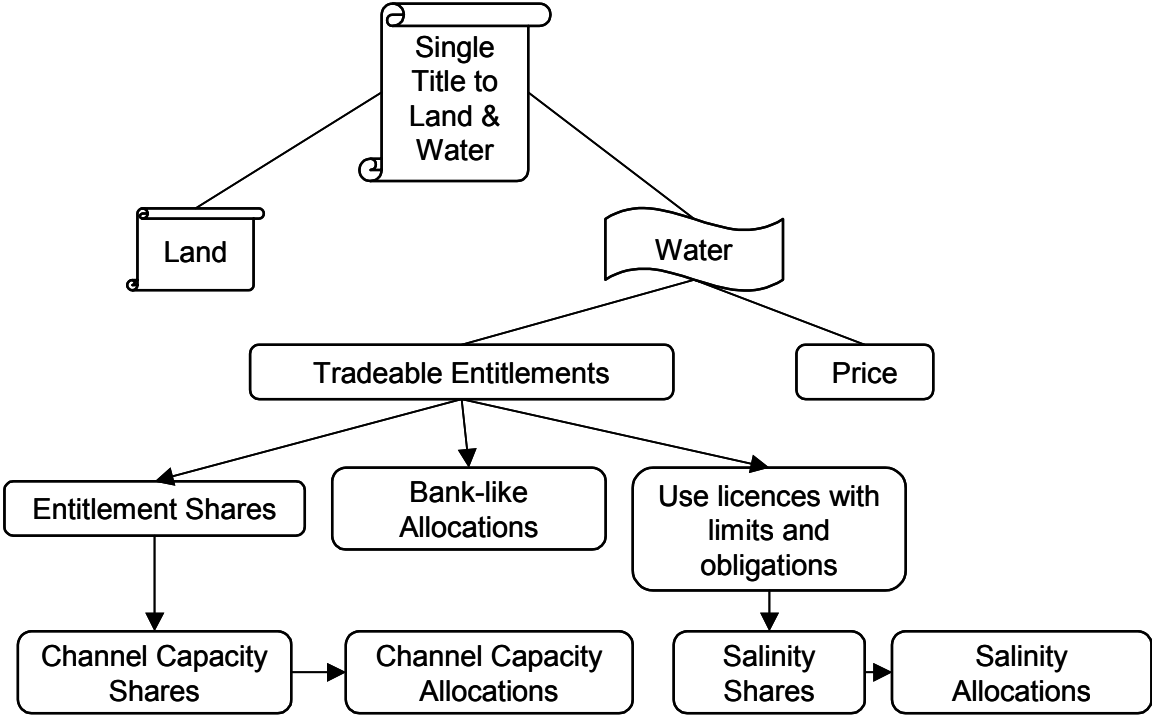
MBIs often evolve through time rather than being designed and adopted as a once-off change in environmental management. This is particularly the case as most environmental legislation within which MBIs are created, or which MBIs are added onto, was enacted before MBIs became widespread (see the discussion in Hockenstein, Stavins and Whitehead 1997). For example, consider the evolution of the Hunter River Salinity Trading Scheme from regulations on discharges to the Hunter River through a trial MBI and finally to a legislated MBI. Hence, policy interventions can be designed to set instruments on a path towards increased efficiency through continued policy evolution rather than as a once off change.

The baseline target outcome may change for many MBIs through time due to changes in tastes, relative scarcity and other factors. Consider for example the evolution of 'duty of care' shown in Figure 3.3. Any MBI designed to achieve the desired environmental standard in these circumstances will need to be able to incorporate a continually shifting baseline without unduly compromising other aspects of the instrument. A similar, though not strictly equivalent, example is the adjustments to water markets to account for the variation in available stocks due to climatic variations through time. Hence, water allocations are measured as a share of available water rather than a fixed volume.

Usually rights bundles comprise a number of potential benefits and obligations. A more complex example of one bundle of rights is shown in Figure 3.4, that relating to water in managed irrigation areas. In this example an irrigation licence (or share) held as part of an irrigation area entitlement currently implies access to a specified share of the water allocation, access to the delivery system, and the right to discharge water into a shared aquifer that may eventually deliver salt and water back to the river system. Potentially each of these benefits can be separated just as the water licences have been severed from a single title to land and water.

Despite the fact that at least some aspects of most MBIs evolve through time, and the potential improvements to theoretical efficiency that may result, many stakeholders do not view this as a positive. Instead stakeholders are often concerned about the lack of predictability in MBIs and the potential 'that the rules of the game will be changed in midstream' (Hockenstein, Stavins and Whitehead 1997).

Figure 3.4: Potential unbundling of property rights as institutions evolve



4. Conceptual and design frontiers

The recent focus on MBI design and implementation within Australia and overseas has done much to identify good design principles and develop effective MBIs. This research has also contributed to identifying what we don't know about MBI design and application, both in terms of conceptual and theoretical frontiers and in terms of practical design.

4.1 Conceptual frontiers

A large body of economic theory has been built up focusing on the behaviour of individuals and firms in differing types of markets. However, a large proportion of this literature deals with '*homo economicus*' or rational economic man in a strict profit maximising setting. Recently, however, there has been a renewed focus on the importance of the institutional context of decision-making through via an emphasis on transaction costs and institutions through the 'new institutional economics' driven by Ronald Coase, Oliver Williamson and others. The new institutional economics stresses the importance of understanding behaviour within the institutional context that it is generated. Other emerging streams of theory within evolutionary economics are also helping to understand the evolution of institutions and the response of individuals to institutions. Yet despite this renewed focus on human-institutional relationships our understanding of human behaviour in response to different instruments is incomplete. A more complete understanding of human response would help in designing more effective and acceptable MBI frameworks. Such an understanding may also assist in understanding how equity trade-offs should be incorporated into instrument design.

In a similar vein we also know that institutions are not isolated. New institutions generate feedback into the community in which they are embedded. They change expectations about what is acceptable behaviour and may change the allocation of entitlements and corresponding duties. However, little is understood about the nature of this feedback and what it means for institutional design, or more generally for the way future instruments are considered.

A further related area is the evolution of instruments through time. Evolutionary economics is starting to provide some theory for understanding institutional change, but this is in an embryonic stage and much is yet to be learnt. Similarly little is known about how different instruments should be mixed through time to achieve an optimal outcome, particularly given that no instrument operates in isolation but instead will inevitably generate feedbacks to and from other instruments.

While there are many other areas in which the conceptual framework is weak the final area considered here is governance. It is generally assumed that the governance of MBIs will fall to formal government institutions. However, this need not be the case. For example, The MarketPlace Company manages trades and the register for the national Renewable Energy Certificates program (RECs). While there is evidence to suggest that there are efficiency gains from specialised private sector providers undertaking such roles there is little theory to suggest whether there are limits or other governance issues related to private sector provision.

4.2 Design frontiers

Even where the conceptual framework is robust there remain many areas of instrument design that can either be improved or about which relatively little is known. This is particularly the case when the internal structures of many government agencies and firms are not equipped to cope with MBIs (Hockenstein, Stavins and Whitehead 1997). We have identified nine areas for which either little is known or for which design can be much improved:

1. Robust instrument design: to date most MBIs have been largely designed on a case by case basis. However, it is likely that there are clear components or modules and rule structures that are applicable in most circumstances.
2. Instrument financing: who should pay for the design, implementation and ongoing management of the MBI? How should these payments be structured so as to provide ongoing incentives for efficiency within the organisational structures needed to manage the institution?
3. Instrument nesting: many environmental issues will require more than one instrument to achieve the desired outcome. In these cases how are MBIs nested with other instruments, or with other MBIs?
4. Instrument sequencing: related to instrument nesting, which instruments should be implemented first? How should instruments be sequenced to encourage evolution towards more efficient MBIs in the future?
5. Instrument delivery: Should MBIs be delivered by regional NRM organisations, through local or state government, private sector providers, specific organisations created for their delivery or some mix of the above? Should the delivery vehicle differ for different issues or in different locations?
6. Design trade-off and compromise: Most instruments will require some trade-offs in design to meet other goals, but what can be traded-off without compromising the efficiency and effectiveness of the instrument?
7. Development process: what path should development and implementation take? Who should be involved and at what level?
8. Enforcement: What rules and regulations are needed to ensure effective MBIs? How should these be drawn up and who should enforce them?
9. Evaluation: What needs to be done to identify whether the MBI is effective and has achieved the goals that were set? Who should undertake this process?

5. Conclusions

The papers in this volume cover the underlying theory, practical application and case studies, and broader context of MBIs for natural resource management in Australia. These papers highlight the successes in MBI application to date in Australia, as well as the essential concepts and issues in their design and implementation. Despite the apparent promise offered by MBIs many potential pitfalls remain in their application. These pitfalls can be minimised by good MBI design, particularly with respect to:

- setting appropriate property right structures;
- taking into account the implications of equity concerns as a fundamental element of whether the instrument so designed would be politically and socially acceptable;
- designing MBIs to account for risk and an absence of information, but also considering the implications of these constraints for alternative instruments;
- incorporating flexibility in order to maximise the gains from trade yet achieve the desired environmental outcome; and,
- account for potential instrument evolution but consider the implications for sovereign risk to participants and uncertainty to communities that may result.

Despite the potential for good MBI design to minimise the potential pitfalls many conceptual and practical design issues remain to be solved. Conceptual issues include a more complete understanding of human behaviour in alternative institutions as well as a more complete understanding of the evolution and integration of different institutional mixes through time and across the community. Among the many design issues that remain some of the most important relate to cost effective instrument design and delivery, both in a narrow single-MBI sense, and in a broader environmental policy environment made up of many instruments that generate feedbacks and behavioural change in other neighbouring instrument environments.

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