

No Easy Exit: Property Rights, Markets, and Negotiations over Water*

Alan Richards and Nirvikar Singh

Department of Environmental Studies and Department of Economics
University of California, Santa Cruz
Santa Cruz, CA 95064

Abstract

The role of water has featured prominently in the Israeli-Palestinian negotiation process, and in Arab-Israeli disputes in general. The allocation or reallocation of water rights is a particularly thorny problem. Recent work (Fisher, 1995) seeks to sidestep the issue of rights allocation by appealing to the Coase theorem, which provides conditions under which the efficient use of a good does not depend on the allocation of property rights. It instead emphasizes the small use value of the water in dispute, and concludes that a trade of “water for peace” should be eminently possible. Here, we provide a critique of this conclusion, based on two central ideas. First, the conditions of the Coase theorem are not satisfied, even approximately, and therefore the valuation of the use of water cannot be analytically separated from the allocation of property rights. Second, the existence of subnational interests, and the need to have an agreement acceptable to important actors at this level, creates a further difficulty for negotiating a resolution of any dispute. Even if a trade at the national level can be agreed upon, domestic losers must be compensated enough to make it politically feasible for the national government.

Contact information:

Address: Department of Economics, Social Sciences 1, University of California at Santa Cruz, Santa Cruz CA 95064, USA (Singh)

E-mail: arr@cats.ucsc.edu (Richards); boxjenk@cats.ucsc.edu (Singh)

Phone: 831.459.4093 (Singh), Fax: 831.459.5900 (Singh)

Introduction

The role of water has featured prominently in the Israeli-Palestinian negotiation process, and in Arab-Israeli disputes in general. Increasing water scarcity continues to drive this prominence. The allocation or reallocation of water rights is a particularly thorny problem, made worse by the multiple levels of actors involved: subnational interest groups and constituents, as well as national governments and other representative bodies. Recent work (Fisher, 1995 in particular) seeks to sidestep the issue of rights allocation by appealing to the Coase theorem in economics, which provides conditions under which the efficient use of water does not depend on the allocation of property rights. This work instead focuses on estimating the use value of the water in dispute, and finds that the estimate is relatively small. The conclusion drawn from this low number is that a trade of “water for peace”, or more generally, a resolution of the dispute over water, should be eminently possible. In this paper, we provide a critique of this conclusion.

Two ideas are central to our analysis. First, the conditions of the Coase theorem are not satisfied, even approximately, and therefore the valuation of the use of water cannot be analytically separated from the allocation of property rights. Second, the existence of subnational interests, and the need to have an agreement acceptable to important actors at this level, creates a further difficulty for negotiating a resolution of any dispute. Even if a trade at the national level can be agreed upon, domestic losers must be compensated enough to make it politically feasible for the national government.

The structure of the paper is as follows. In the next section, we review the empirical and analytical issues, and the work of Fisher (1995). Following that, we introduce our basic arguments with respect to the Coase theorem. Next, we further discuss the issue of water markets as asset markets. We argue that conceptualizing water markets in this way is crucial to supporting institutions for efficient water allocation. We then discuss the two-level perspective applied to bargaining over water. Again, while we point out the difficulties created by the existence of two (or more) levels of bargaining, we discuss how recognizing these difficulties, rather than attempting to side step them, can help to provide a solution. We conclude the paper by drawing out some general implications of our analysis.

Can Economics Save Us from “Zero-sum Thinking”?

Increasing fears of “water shortages”, even of “water wars” have become commonplace in discussions concerning the arid regions of the developing world. (For example, see *The Economist*, 1995-96). Such fears are voiced often for South Asia and, especially, for the Middle East. The role of water looms sufficiently large in Arab-Israeli disputes and peace negotiations to warrant a special entire section of the Israeli-Jordanian Peace Treaty and to feature prominently in all discussions of the future of the Occupied Palestinian Territories. Conflict over water seems to elicit deep fears and to provoke extreme public statements. There is widespread concern over the ways in which conflict over water can and does aggravate already intractable struggles over land, sovereignty, borders, and so forth.

In such a volatile, dangerous environment of conflict, it is perhaps natural that economists have taken the lead in proposing increasing reliance on market allocation of water as a potential solution to, at least, the conflict over water. Economists, of course, believe that a “shortage” of anything that is useful cannot be defined without reference to its price. If shortages persist for an extended period, economists always suspect that something is interfering with the price mechanism. The fact that it is quite evident that water is often used inefficiently — not enough going to the user who values water the most, too much to those who value it less — adds to economists’ suspicions that a pricing mechanism is absent or very weak. These considerations lead to a call for institutional change, for the creation of water markets, markets which, it is often argued, will both eliminate scarcities and greatly ameliorate conflict over water.

Such considerations are typically found in proposals for reform of water allocation policy at the national level. Policy reforms are complicated, of course, by the international dimension: rivers and aquifers typically cross national boundaries, and this dimension provides the urgency of the fears alluded to in the first paragraph. Any national policy has to take into account issues of transnational water sharing, and securing international agreements on water has been, to say the least, difficult and elusive. (See Putnam, 1988, and Richards and Singh, 1997, on two-level games.)

Conceptually, there are perhaps three major positions on the principles by which property rights to water could be allocated. These positions have been characterized elsewhere (Richards 1994; see also Barrett, 1994) as “Harmon, History, or Hobbes”. “Harmon” refers to the Harmon Doctrine, widely used in the U.S. West, in which the rights of those who own land at the source

of the water (e.g., where the rain falls, or upstream actors generally) take precedence over others. In the Middle East, such a position is often taken by Palestinians, who assert that “since the rain falls on our roof, it belongs to us”. The polar opposite doctrine, “History”, refers to the position that the rights of historical users of water, wherever they may be located geographically, should take precedence over others. Unsurprisingly, Israeli spokesmen often adopt such a position, arguing that since they made the investments and developed the water systems, their rights should come first. Needless to say, these principles of Harmon and History are diametrically opposed in many cases. Any choice between such principles seems to most outsiders inherently arbitrary and a mere cloak for the interests of the respective parties.

The third allocation principle dispenses with any concept of prior rights to water. It merely says that rights to water are what the interested parties agree to; the allocation of water rights is the outcome of a negotiation, a bargain, in which, inevitably, relative strengths will matter. This is the “Hobbes” principle, which asserts that the only way to decide the allocation over property rights is to “do a deal”.

The problem with the third principle is, of course, that there is more than enough Hobbesian behavior in the region (and elsewhere!) already. Trying to divide water rights, like the allocation of any property right, is inherently a “zero-sum game”. More accurately, it is a “pure conflict game”, where any increase in one player’s utility necessarily decreases the other player’s. This includes zero-sum games as a special case. We will continue to use “zero-sum” because the term is popular and captures the essence of the issue very starkly. The Middle East,

in particular, has had generations of experience with the consequences of viewing state relations through a zero-sum lens.

In such doleful circumstances it is perhaps unsurprising that some analysts have attempted to side step the thorny problem of assigning property rights to water. To take a recent prominent example, Franklin Fisher and his colleagues at MIT and Harvard have argued that it is possible to by-pass the property right question by focusing instead on water use: “the question of water ownership rights and the question of water usage are analytically independent and should not be confused”. On this assumption, they proceed to quantify the benefits of water use. They find that these annual benefits to the current users of water in the region are “small”: \$110 million for 1995, rising to no more than \$500 million per year by 2020 (Fisher, 1995, p. 379; Berck and Lipow, 1994, had previously proposed a similar, but much smaller transfer, valued at \$10 million annually). They then conclude that with appropriate side-payments, it should be relatively easy for the nations of the Mashreq to come to agreement on water sharing. They argue that all the fuss about water conflict and negotiations is, in effect, much ado about nothing. For example, Fisher (1995) states, “the property rights issue – the question of who owns the water – should not be nearly so difficult to resolve as is generally supposed” (p. 381). He does go on to say, “Nor do we claim that the question of who owns the water is unimportant” (p. 381), but later concludes “ownership rights are not, in fact, tremendously valuable” (p. 388).

The argument is understandable: if it is possible to break out of zero-sum thinking, then any observer of the Middle East would be delighted. The argument is ingenious: by looking beyond the conflict over property rights, it tries to shift our focus onto water’s productivity in

agriculture, industry, and services, and its utility in consumption. The argument is helpful: it provides a significant attempt to quantify the value of water in dispute. The authors are surely right that if water's value were perceived to be some \$110 million annually, the chances of conflict might be reduced. There is little doubt that the paper has made a real contribution to the debate on water allocation mechanisms in the region; it is unsurprising that the argument has received so much attention.

However, the argument is also flawed in its most fundamental premise: it is *not* possible to separate questions of water ownership rights from questions of water usage. The questions are, in fact, *not* analytically independent. Economics does not offer a neat exit from the brutal zero-sum world of determining an initial allocation of property rights.¹ Markets will not provide a sword to cut that Gordian Knot. This paper elaborates the counter-argument: allocating property rights and questions of water usage are inseparable. The fundamental problem is that the separation of use and property rights can only be done under certain conditions, and that these conditions are unlikely to be met in the case of water, especially in the Middle East.

The message of our paper, however, is not purely negative. Focusing on the importance of property rights allows one to understand better how negotiation may achieve some kind of allocation of rights, and how this may support, with appropriate regulation, reasonably functioning water markets. Here we will emphasize the importance of having the right conceptual framework to set about managing negotiations and designing institutions to govern markets. We emphasize the importance of recognizing the asset nature of water, and the multiple levels of users of water.

Why the Coase Theorem Does Not Apply to Water Issues

The Fisherian perspective (if we may so label it) is fundamentally a particular application and interpretation of the Coase Theorem. The Coase Theorem states that the efficient allocation of resources is, in certain circumstances (to be elaborated below) independent of the initial allocation of property rights. The perspective also thinks of (potential or implicit) water markets as spot (as opposed to asset) markets. For example, Fisher (1995) states, “the transfers envisaged in our work are only temporary ones. We are not talking of a permanent sale of historic rights. Rather, we envisage the sale of permits allowing some party other than the owner to use the water for a limited time.” By contrast, we argue:

- The presence of (often large) transactions costs makes it impossible to separate questions of use from questions of the allocation of property rights, and
- Water markets are better analyzed as asset, rather than pure spot, markets.

Two consequences follow from these propositions:

- There is no escaping the need to negotiate a division of property rights over water, and this will be more difficult than postulated by the MIT/Harvard project. Unfortunately (but unsurprisingly) Thomas Hobbes and his contracting perspective are alive and well in the region.
- Because water markets are really asset markets, there is no escaping the need for certain kinds of public regulation. In a transnational context, this prerequisite

strongly suggests that transnational institutions can, indeed must, play a crucial role in moving nations toward greater reliance on water markets.²

There are two necessary conditions for the Coase Theorem, which states that the distribution of property rights will have no consequence for the allocation of resources, to hold:

- “wealth effects” do not exist, and
- there are no transactions costs.

Both wealth effects and transactions costs are ubiquitous in water allocations, nullifying the utility of the Coase Theorem, and, therefore, the notion that water allocation mechanisms which “finesse” the problem of property rights divisions exist.

Consider the first condition, the absence of wealth effects. This requires that:

- 1) given any two alternative decisions x and y , there is a specific amount of money, $\$z$, which would compensate a decision maker to switch from x to y , or from y to x ;
- 2) if the decision maker were given some additional amount of money, the amount necessary to induce him/her to switch from x to y , or y to x , would remain the same ($\$z$);
- 3) the decision maker must have enough money to absorb the wealth reduction necessary to pay for switching from the less preferred to the more preferred option (Milgrom and Roberts, 1992, p. 35).

One puzzle facing economists who analyze water in the Middle East (and elsewhere) is the oft-heard statement by highly informed local experts that “our water is not for sale”. Employees in US government agencies responsible for trying to further regional water negotiations often bemoan the fact that “they (i.e., regional government officials) do not think of water economically”. We believe that such statements may reflect more than bargaining positions, that they refer to the presence of wealth effects. We believe that, when water markets are conceived of as asset markets, regional actors’ statements on water may be seen as highly rational statements — they simply reflect the presence of wealth effects.

Such a finding will come as no surprise to those familiar with the environmental economics literature, where the distinction between “willingness to pay” and “willingness to accept” is commonplace. “Willingness to pay”, of course, assumes that one does not own the good; it is the “buyer’s price”. It is, therefore, subject to the income constraint. By contrast, “willingness to accept” is the “seller’s price” or price which one is willing to accept to part with a property right. This price is *not* income constrained. Unsurprisingly, empirical studies have found that willingness to accept exceeds willingness to pay; a standard survey of the literature (Bromley, 1995) finds that willingness to accept is on average three times greater than willingness to pay.

Such divergence between willingness to pay and willingness to accept--and, therefore, the impossibility of “finessing” the question of the original allocation of property rights--may have an additional source as well. If agents behave according to the logic of prospect theory or loss aversion, in which “the response to losses is more extreme than the response to gains” (Tversky and Kahneman, 1990, p. 67), then agents’ willingness to pay, for what they do not own, will be less than

what they must be paid, to give up what they do own. (For a review of the evidence and additional argument on this point, see Tversky and Kahneman, 1990). The presence of income effects, together with the likely presence of loss aversion, helps to explain why so many agents throughout the world say, "Our water is not for sale" -- property rights matter.

Further, such statements also reflect the presence of (very large) transactions costs. Although there are many of these, we focus on two related issues: the role of uncertainty, particularly uncertainty with respect to enforcement of contracts, and the problems of making credible commitments (see below). Regional actors often do not believe that the sums that they would require to part with water would actually be paid. Put in financial language, the risk premia on such contracts are very high. Once these risk premia are incorporated into the price of the transfer, the amount may become so high that the scope for a transfer no longer exists: the incentive for following through on the commitment may itself be adversely affected. In other words, there is a moral hazard problem: this kind of argument is detailed in the case of credit markets in Stiglitz and Weiss (1981).

A related uncertainty and transaction cost arises from the problem of enforcing contracts. Not only is enforcing contracts not costless, but also the cost of enforcement may appear to potential market actors as prohibitive or unattainable. If a country (e.g., the Palestinian Authority) does not own a) residual decision-making rights and b) residual rights to the income stream generated by the utilization of the asset, then such a country is faced with very large uncertainty on the other party (e.g., Israel) reneging on the contract. In the international context,

this problem of enforcement is well recognized: Barrett (1994) highlights it for the case of water agreements. We next discuss this issue of uncertainty further.

Willingness to enter into any contract requires that agents have an answer to the fundamental contracting question, “How do I know that the other party will keep his/her side of the bargain?” There are three broad classes of answer to this question, only one of which is even remotely apposite in Middle Eastern water questions:

1) “Because if they renege, I can take them to court”. A host of questions arise. What court? Which court? Most fundamentally, whose court? Using which set of rules? Enforced by whom? Their government? Our government? A third party? Who are they? These questions have no easy answers in general situations involving sovereign nations. In the Middle East, the history of mistrust exacerbates the difficulties.

2) “Because we are in a repeated game, and they value their reputation as someone who complies with agreements”. It would be difficult to imagine a historical-political setting in which the respective “reputations” of the parties were more tarnished in the eyes of the other (the only thing that “reputation” means in this context) than in the Mashreq. The mutual suspicion, often amply justified, of each party for all the others is enormous. Reputation mechanisms seem highly unlikely to help answer the fundamental contracting question.

3) “Because if they renege, they will lose *other* things which they value highly”. This reflects the often noted phenomenon that water agreements are typically “the tail of the dog”, that

they are arrived at only after, and as part of, more general strategic agreements (e.g., Israeli-Jordanian Peace Agreement). From a theoretical (and practical!) perspective, the fact that military security, the quintessential public good, must be introduced to get an answer to the fundamental contracting question immediately alerts us to the inapplicability of the Coase Theorem in transnational water systems. The inseparability of property rights division and resource allocation, and the importance of subnational interests in national level transfers must be centrally addressed.

Whatever the answer to question of how contracts are enforced, water contracts are inevitably subject to *uncertain contingencies*. There may be a severe drought; there may be outbreaks of crop diseases; the prices of imported foods may suddenly rise, and so on. It is highly likely that, in an environment of profound distrust, the subjective probability of the occurrence of negative shocks is an increasing function of the extent to which water supply sources are owned/controlled by (deeply distrusted) foreigners. And, of course, even if one considers insurance for such contingencies, then we introduce another version of the moral hazard problem discussed above in the context of enforceability. This problem of uncertainty is assumed away in the Harvard/Fisher project, which uses a steady-state model, assuming all years are average years. The nature of water as a necessity, as well as the substantial complementary investments that may accompany its use, imply that small reductions in available quantities can push up marginal valuations dramatically. The use of average availabilities ignores this significant issue. The importance of this problem may be illustrated by one of the most significant and longest-running international river disputes, over sharing the waters of the Ganges between India and Bangladesh. The absolute center of that dispute is the sharing of dry season

flows, which can be precariously low in abnormally dry years: see Crow *et al* (1995) and Crow and Singh (2000). Berck and Lipow (1994) tackle this sort of issue through prioritized rights -- we discuss this in the next section.

In short, the Coase Theorem does not, and cannot, hold for transnational water agreements, and therefore, for transnational water markets. It follows that, unfortunate although this fact is, we cannot legitimately separate questions of the distribution of property rights over water from questions of the allocative efficiency of water. There is no “Alexandrine sword” to cut the Gordian Knot of Middle Eastern water conflicts.

Water Markets as Asset Markets

Part of the problem with applying the Coase Theorem is that transnational (and other) water markets are typically conceived of as spot commodity markets—the simple markets of Economics 101. By contrast, we believe that water markets bear a much closer resemblance to asset markets. Such a perspective draws our attention to the need for public authority, regulation, and all the other basically political issues that the “Harvard/Fisher Approach”, while acknowledging them, seeks to finesse.

To understand the danger of focusing purely on spot transactions, consider the status of markets for groundwater in India. These are sometimes viewed as increasing the efficiency of the use of water, since individuals with low marginal values can sell to those with higher

marginal values. However, there is no prior allocation of water rights in such cases, and ownership is simply *de facto*, through the use of pumps. The overall use of water, therefore, does not necessarily reflect its true scarcity value.

Groundwater is easily understood as a resource stock, and therefore as an asset. However, it may seem less satisfactory to treat river water as an asset, since it is a physical flow rather than a physical stock, unless it is dammed or otherwise stored. After all, spot markets are markets for flows of benefits per unit of time, while asset markets are markets for stocks. Nevertheless, from an economic perspective, water markets are better viewed as asset markets for rights, as well as spot markets for temporary use of those rights. Even for the flowing river, the right to draw on that water year after year is what ultimately matters. That annual right to the physical flow of the river constitutes an asset. We expand on this idea below.

Simply stated, asset markets are markets for implicit or explicit long-term contracts. I buy the stock of the asset because it yields a flow of benefits over time. If I buy the stock — rights to the stream of benefits — rather than buying the flow (through renting the stock), it is because I think there is some advantage to doing so. As recent theories of industrial organization (e.g., Williamson, 1975, 1985; Milgrom and Roberts, 1992) teach us, the fundamental reasons for a firm to own a resource (entering the asset market) as opposed to renting it (entering the spot market) has to do with the presence of significant uncertainties and information costs (or, more broadly, with transactions costs). With long-term contracts (or asset markets), we must immediately face the issue of uncertainty and imperfect information with respect to (among other issues):

- future “states of the world”—and, therefore, the problem of necessarily incomplete contracts;
- future enforceability of contracts (see section III);
- problems in determining the future quality of the asset (problems of adverse selection; problems of water pollution).

A further complication is as follows. To use water, to derive utility from purchased (say) water rights, I typically must also invest in complementary infrastructure. Nearly all water consumers consume water as *conveyed to them* through pipes and canals, and in the case of urban users, after having been treated in large plants. These are large, lumpy assets, which require costs now, to reap benefits later. The benefits from such infrastructure will only justify the costs if I can overcome the problems of uncertainty. Such investments, once made, are irreversible. If the benefits to be derived from such investments are to justify such investment, then I must be able to overcome the problems of uncertainty and enforcement of contracts. My question becomes, “How can I protect my investment in infrastructure? That is, how can I ensure that they will deliver water as agreed?” As we have seen, in a world of deeply distrustful sovereign states as actors, there is no simple answer to this question.

The necessity of large, indivisible complementary assets in enjoying the benefits of water is what makes the asset dimension of water markets so significant. No one can buy land, or build dams or pipes, without some long-term guarantee of water availability. A homeowner in an industrialized nation’s city may confidently expect to be able to receive household water without

signing a long-term contract for its delivery. Well-established local governments and courts back up this expectation. In a less certain situation, a long-term contract may be enough: say the city contracts with the owner of a far-off source of water for delivery of a fixed amount per year for 30 years. Again, courts and state governments exist to support this arrangement. In a still less certain situation, where availability is uncertain, needs are uncertain, and enforcement is uncertain, the only alternative may be outright ownership. Then water, though divisible over time and at a point in time, becomes like an indivisible asset.

It may be noted parenthetically that such a consideration needs to be applied to the Fisher *et al* calculation of the “small” value (\$110 to \$500 million per year) of the benefits of water in the Mashreq. If such benefits are viewed as a stream extending into the indefinite future (i.e., as a perpetuity), then the present value of such benefits discounted at, say, 5% is about \$3 billion.³ Although this may seem “small” compared to the size of the Israeli economy’s GDP of some \$95 billion, it is not small compared to that of Jordan’s (\$6 billion) or Syria’s (\$17 billion), much less the much smaller GDP of the Palestinian Authority. Of course this involves comparing a stream of future benefits with the value of one year’s economic activity. However, lumpy investments do show up in a single year’s GDP. For example, Fisher (1995) compares annual benefits with the (capital cost) of military equipment (p. 386). Perhaps the most important comparison is between the size of the estimated yearly benefits and the Palestinian Authority’s GDP, in which case the benefits are clearly large relative to the economy.

The importance of these issues of relative size is further highlighted when one examines the Fisher proposal further. This appears not to involve transfers of ownership rights at all, beyond an establishment, based on history, of what these rights are. Indeed:

[T]he transfers envisaged in our work are only temporary ones. We are not talking of a permanent sale of historic rights. Rather, we envisage the sale of permits allowing some party other than the owner to use water for a limited time. As with all voluntary trades, such permit sales will benefit both buyer and seller. (p. 382)

In this world, spot prices and quantities will keep adjusting, helped along by the project model, which will provide “a guide in setting prices” as well as forecast future prices. If a political entity does not wish to sell such temporary permits, then “it has placed too low a value on the water, and the price should be adjusted upwards.” If we are interpreting this correctly, Israel will continue to hold “historic” ownership rights, and the Palestinians will have to pay what the model suggests for additional water -- unless, of course, the Israelis want more than that.

The problem just highlighted is not simply one of prior bargaining power. The presence of lumpy, fixed investment as a necessary component of water markets immediately creates what the literature on the economics of the firm calls “the hold-up problem”. This is a form of the “incomplete contracting problem” which plagues asset markets, and becomes particularly acute when alternative suppliers are not readily available. Once I have invested in infrastructure, what is to prevent my (despised and distrusted) contracting partner from taking advantage of my sunk costs to renege on his original agreement, and try to strike a still tougher bargain? The only ways out here are ownership of the complementary asset, in this case the water, or competition in the

supply of that asset -- somewhat easier to envisage for manufacturing firms than for the political entities of the Mashreq.

Considerations of risk and lack of substitutability suggest that water markets are likely to be “thin” markets. Furthermore, water rights may be usefully thought of as “idiosyncratic rights”: rights to highly geographically specific commodities—it is not usually possible to find other sources of water for a system of canals, pipes etc. than the one stream or river which feeds into it. This suggests that the housing market may be an appropriate analogy for water markets. Here, too, idiosyncratic, often thin, asset markets display a number of imperfections thanks to the presence of uncertainty and the impossibility of writing and enforcing contracts to cover all possible future states of the world. In theory, as in practice in the housing market⁴, one could deal with the problems of financing such investments through mortgage lending. In the U.S, interestingly, formerly highly fragmented mortgage markets did, indeed, give rise to a wide variety of imperfections, and were accordingly subject to a wide variety of government regulations. More recently, financial innovations have occurred which pool risks (i.e., mortgage backed securities), and are then resold in a secondary market. That is, the idiosyncrasies of the housing market are transformed by creating a financial market. Perhaps water markets would require something similar.

Note, however, that regardless of whether the idiosyncratic water market (that is, potential market) is viewed as an “old style” mortgage market—with its fragmentation and “thinness”, or as more modern “mortgage backed security market”, the need for regulation, for public action, for governmental authority, and, in a transnational contest, for a negotiated agreement is

essential. Whether direct (thin, idiosyncratic) markets or financial markets are required, or both the need for regulation and public oversight in the presence of widespread uncertainty and contract enforcement problems is inescapable. The role of such regulatory bodies (water registries, water councils, and watershed authorities) can be to resolve information problems such as monitoring quantity and quality, and to provide mechanisms for cost-effective dispute resolution. For example, Holden and Thobani (1996), in reviewing the experience with tradable water rights, discuss a public Water Rights Registry, specifying “the flow or volume...; the point at which the water will be diverted; whether it is for consumptive or non-consumptive use and whether it is for permanent or temporary use; the point and form in which the water will be returned to the river system; and the amount paid for the rights.” See also Rios Brehm and Quiroz (1995) and Gazmuri Schleyer and Rosegrant (1996). More broadly, the regulator sets and enforces the rules of the game, as is invariably the case with well-functioning asset markets. Once again, however, the implication is that there is no escaping the admittedly difficult, nasty problem of allocating property rights, and of creating either transnational or bilateral agreements over such rights.

How might property rights be assigned in practice, particularly given the problem of uncertain total availability? Berck and Lipow (1994) suggest an approach based on prioritized rights, also in the context of the Middle East. These are rights ranked on the basis of priority, so that lower-ranked rights can only be exercised once higher-ranked rights have been satisfied. Note that these are permanent asset-based rights, which may be sold or leased. The analogy with financial assets such as preferred and common stock is straightforward. In fact, Berck and Lipow demonstrate that prioritized rights that are fully vested and fully tradable can span the same space

as a full set of state contingent claims, hence achieving Pareto optimality in a theoretical model. Zeitouni, Becker and Shechter (1994) also propose priority claims, with two difference from Berck and Lipow. First, they make their proposal in the context of transnational markets for water. Second, they propose a specific institutional mechanism, namely sealed-bid auctions, for implementing the market. Zeitouni *et al* appear to propose a *de novo* allocation of rights through auctions by a hypothetical “international water bank”. They admit that they “largely disregard important institutional and political aspects of the problem”.

Berck and Lipow note the well-recognized fact that existing policies in Israel and the ‘Disputed Territories’ are not characterized by efficient water contracts, being driven instead by strategic and domestic political objectives. Therefore they also advocate reforms in pricing of water, reduction or removal of distortionary regulation of agriculture, and the depoliticization of needed water regulatory authorities by separation from ministries. Issues of compensation of losers from transfers, and the actual working of the regulatory bodies are not really addressed. Hence, while they provide a more sophisticated and complete conceptual analysis than Fisher, they do not fully come to grips with the issues raised here. Clearly, however, water markets for leasing and selling rights are more workable at the microeconomic level. Many papers have articulated this case, and discussed the problems of the actual workings of water markets in countries such as Chile and Mexico. A particularly clear analysis is that of Holden and Thobani (1996), which also references much of the other work in this area. As we shall argue in the next section, the focus on microeconomic mechanisms is a sensible step towards solving transnational conflicts.

The Perspective of Two Level Games

In our view, managing water scarcity will require two fundamental changes: domestic economic policies will have to be reformed to rationalize water use (see World Bank, 1993, for a summary of many of the Bank's arguments in support of this proposition), and transnational agreements on water sharing must be forged.⁵ Each of these problems is difficult enough by itself. However, they are intimately interrelated. In effect, each national government is engaged in a "two-level game" (Putnam, 1988; Iida, 1993; Lax and Sebenius, 1991; Mayer, 1992; Mo, 1995; Richards and Singh, 1997). Each government is simultaneously trying to reform its domestic water regime while also negotiating with its neighbors over how to share the river's resources. But a move in one game will typically have implications for the outcome of the other. International water negotiators are looking over their shoulders at domestic political conflicts over economic reform, while advocates and opponents of economic reform monitor international developments for its domestic implications.

There are numerous examples of such two-level games over water. In the example that is the main focus of this paper, Israel, Jordan, and the Palestinian National Authority are negotiating (or have negotiated) over sharing the Jordan and Yarmouk rivers, as well as mountain aquifers. Simultaneously, Israel and Jordan each face issues of reallocating water between urban and rural users internally (Just, Netanyahu and Horowitz, 1996). The Colorado River has been the subject of negotiations between the United States and Mexico, as well as among the riparian states in the US (Friedkin (1987); Ramana (1992), pp. 68-69). Sharing the waters of the Ganges

river has been a point of contention between India and Bangladesh for several decades, while both countries have had to devise schemes for apportioning their own shares among different user groups and/or regions (Crow, *et al*, 1995; Chaudry and Siddigi, 1987); National Water Development Agency, 1992). The Indus and its tributaries became the focus of intense bargaining between India and Pakistan after India's partition in 1947. Simultaneously, India has had to allocate its share of water from this basin to several different states (Barrett, 1994; Dhillon, 1983).

In the above examples, there are often more than two players at the subnational level. As a first approximation, however one can sometimes focus on only two groups within a country. One may think of this as "urban" versus "agricultural" interests; in fact, the interests of these groups are often in conflict. For example, the city of Amman faces increasingly serious water shortages while farmers in the (irrigated) Jordan Valley enjoy substantial subsidies to grow water-intensive crops such as bananas, in which Jordan has no comparative advantage. Alternatively, we may think of the groups as political entities, e.g., the states of Punjab and Haryana in India.

Some examples of the problems created by the existence of two levels of bargaining may be noted:

- 1) Water rights are traded for peace. This is fine, in principle – but, as noted in section III, this introduces a public good, and therefore, free rider problems. How is this public good

produced? How is it paid for? How is *this* agreement struck, and enforced? This public good problem would not arise if nations were unitary actors, rather than collections of individuals.

2) It is not true, of course, that the current situation is devoid of property rights. Instead, we have a *de facto* allocation of rights, which (at least) one party/nation does not accept. The presence of *de facto* rights means that holders of those rights are now reaping rents from such *de facto* ownership. In the presence of the problems noted above, how are they to be persuaded to relinquish these rights?

We tackle some of the issues raised by the existence of two levels of bargaining in related work (Richards and Singh, 1997). There we examine several alternative (simultaneous and sequential) cooperative bargaining structures (see Harsanyi, 1963, 1977 for an exposition of this framework), and derive some equivalence results and welfare comparisons. Taken together, our results provide a demonstration of why there is often disagreement not only over water, but even over how to negotiate about water. Different institutional arrangements for negotiations can have very different consequences for different actors. A key feature in our framework is that being able to commit to domestic negotiations can improve the bargaining position at the international level. Theoretically, this works through domestic agreement improving the threat point of the international negotiations.

Of course, this is not the only possible consequence of domestic politics for international bargaining. Most obviously, strong domestic farm lobbies may make it more difficult for a national government to make concessions. The argument that “our hands are tied” is often quite

useful in negotiations, (e.g., Schelling, 1960). Alternatively, an unfinished international water negotiation may retard domestic reform, as the negotiating parties fear that any domestic water-savings achieved through reform will reduce their ability to claim a larger share of international water. One obstacle to reform of domestic Jordanian water policy before the peace treaty with Israel was precisely the fear by some Jordanian officials that greater efficiency in Jordanian domestic water use would be seized upon by Israeli negotiators, who would argue that Jordan “needed less water”.

In our (1997) analysis, we also discuss the possibility of complementary, productive investments, undertaken noncooperatively. As noted earlier, water by itself rarely gives utility; it must be stored, moved, channeled, pumped, and piped to be useful. Investments that enhance the utility of water may be local, national, or international. We focus on the impact of national investment on water negotiations. We offer three propositions in this extension of our basic model. First, the optimal allocation of water in one country will depend on domestic investment in the other country, even in the absence of direct externalities, as long as such investment affects the marginal utility of water. Second, if domestic investment affects the marginal utility of water, then, even in the absence of direct externalities, negotiating only over water, and not over domestic investments leads to an inefficient outcome if domestic investments can be precommitted. Finally, whether or not domestic investments can be precommitted before internal negotiations, if they take place after international negotiations, then, in the absence of direct externalities, the outcome in terms of water allocation and domestic investments is efficient. Taken together, these results further illustrate the complications caused by two levels of bargaining.

The analysis is further complicated when one allows for domestic noncooperative bargaining over the gains and losses associated with international agreements: political lobbying games may be such that efficient agreements are unreachable (see Grossman and Helpman, 1995a, b). Even if water markets work, the political markets that would determine the initial conditions for the operation of water markets may not. And only political processes can manage issues of the distribution of the costs of a public good, or the allocation of property rights. Again, questions of use and questions of the allocation of property rights can not be separated.

Do all the complications outlined above mean that no progress can be made? Fortunately, our answer to this question is ‘no’: our analysis focuses attention on the subnational issues that must be resolved before transnational schemes such as the proposals of Fisher, Zeitouni *et al*, or other variants can be considered in a practical manner. We have already emphasized the importance of establishing water rights. We would argue that this cannot be properly done at the national level, but must be first implemented at subnational levels. This allocation of rights does not have to mean individual rights – though some form of individual rights is likely to be necessary in places where family farming is the rule. Instead, they may be corporate rights, vested in water user associations or variants of that organizational form. The reason for suggesting corporate rights is, of course, the problem of asset indivisibility that is characteristic of complementary assets for water use, already discussed in section IV (see also Grossman and Hart, 1986; Williamson 1975, 1985).

This leaves the question of how these rights are to be initially assigned. This problem appears to be sidestepped by all the authors we have referenced here, and we have highlighted the difficult problem of “zero-sum thinking” that motivate that sidestepping. One possible way out of this problem is to try to connect the initial non-cooperative game of rights allocation to the subsequent cooperative game of bargaining over the gains from trade. This is in stark contrast to the approach by Fisher, which seeks to separate the two issues.

The approach we have in mind is that of Bliss and Nalebuff (1984), introduced in the context of a model where there are several individuals with private knowledge of the costs of providing a public good. A single individual can alone provide the public good, but may wait to see if someone else will do so, avoiding his own cost. Against this benefit of waiting (some chance of saving the cost of provision) is the cost of waiting, since the benefits of the public good are forgone until someone steps up to pay. Technically, this game is a war of attrition with incomplete information. Alesina and Drazen (1991) adapt this model to one where the benefit is not a pure public good, but rather is some fixed proportion of a gain from stabilization policy, and where the costs are borne until the stabilization is undertaken. Stabilization occurs only when one party gives in to the other, accepting a lower fraction of the gains.

These models have two applications to our current concerns. First, the Bliss and Nalebuff analysis is directly relevant to the “water for peace” argument, where we have noted that the usual way of posing this solution ignores the subnational level and therefore the problem of who pays for the public good of peace. If the transnational agreement is ratified, then the subsequent subnational game becomes one of pure conflict. However, if the subnational actors play a game

where some subset (not necessarily a single individual or group) steps in to pay the cost -- in this case by giving up water -- then it is very similar to the Bliss and Nalebuff war of attrition. A similar analysis would predict that an agreement could be reached where those for whom the costs of giving up water use are the lowest will agree to do so after some delay. Of course the net gains to each group must be positive.

The Alesina and Drazen analysis provides a similar insight into thinking about the general problem of allocating domestic property rights. This allocation will inevitably be a reallocation and “firming up” of uncertain *de facto* rights. This firming up of rights permits trading of rights, value-enhancing investments, and other actions that might not be possible with uncertain *de facto* rights, creating a potential benefit that is tied to the agreement. Alesina and Drazen have shown that, in their model, the delay in agreement goes down, as the sharing of the benefits of stabilization becomes more equal. The interesting conclusion for negotiations over water rights is that the net benefits of such an agreement may need to be relatively equal to support early “agreement” (i.e., concession by one side to the other). Again, as in the public good example above, the weaker criterion that net benefits to all domestic groups involved in bargaining must be positive is necessary for any agreement at all. In any case, the reason a concession is made is that the conceding party, while giving up some claims or *de facto* rights, gains in other well-defined ways such as trade or investment in water. Recognizing and working with the connection between the two aspects is the opposite of the Fisher/Coase approach.

Where Do We Go From Here?

If there is no easy exit, do the parties to water disputes such as that in the Mashreq have anywhere to go? Let us briefly recapitulate our arguments before summarizing our suggestions for where possible answers may be found. First, valuing the water in dispute independently of a consideration of who owns the water is of limited analytical and practical use. In fact, the situation is not one where the theoretical conditions are met that would unambiguously allow such a valuation. Second, the value of water in dispute is not small relative to particular parties to the dispute, whether entities such as the Palestinian Authority or groups living within a particular country. Third, the problem of negotiation at the international level is complicated by the need to compensate losers at the subnational level – the two-level game problem. To relate this to the second point, \$100 million dollars may be a small amount relative to Israeli GDP, but a large transfer to make to a group of farmers via the domestic political process. Fourth, the assignment of property rights remains a zero-sum game, unless it can be inextricably tied to other issues in the negotiation: the potential loser in the property rights assignment always has an incentive to separate out the water issue from other issues in the negotiation. An outside party with interests in a settlement may attempt to force the linkage, or it may offer conditional bribes to achieve this end. Fifth, even if the property rights assignment can be made, the construction and operation of markets for water is not a simple task, due to the nature of the good: in fact this potential difficulty with water markets makes it more difficult to reach an agreement on property rights.

Given these problems, where do we go, beyond the project-evaluation type valuation provided by Fisher's team? A two-pronged approach is called for, dealing with the working of markets and the allocation of property rights. As we have emphasized, these are interrelated.

- Thinking of water markets as asset, rather than pure spot, markets emphasizes the need for regulation. Unlike in the case of financial markets, much of this regulation need not be at the national level, because the potential market is not national. Some regulation must be at the local level, reflecting local knowledge and conditions. Other regulation must be at the level of domestic river basins. In fact, one can envisage a hierarchy of regulation, following assignment principles such as those used in thinking about the proper assignment of authority in a federal system. Furthermore, given the role of complementary assets in the delivery of the services of water, it should be recognized that ownership need not be individualistic. Firms, after all, are associations of assets with multiple owners. We may think of water associations as ownership associations, rather than as just user associations. Higher-level regulation then specifies the broad terms of governance structures, disclosure rules, bankruptcy rules, etc. In brief, markets will work if institutional structures are in place to support their working.
- The solution to the property rights issue requires an understanding of the bargaining process. In particular, the building of institutional structures for the functioning of water markets may be made a part of this process. Certainly the gains and losses to subnational groups must be considered in the process of international negotiation, and this may affect bargaining protocols. Adding issues complicates the bargaining process, however, and

this, too, must be recognized. Zero-sum games in fact do have Nash equilibria, and this must be understood if the desire is to move from one equilibrium to another, better one, or to create a new equilibrium by changing the game.

References

Alesina, A. and A. Drazen (1991) Why Are Stabilizations Delayed?, *American Economic Review*, 81, pp. 1170-1188.

Barrett, S. (1994) Conflict and Cooperation in Managing International Water Resources, Policy Research Working Paper no. 1303, The World Bank, May.

Berck, P. and J. Lipow (1994) Real and Ideal Water Rights: The Prospects for Water-Rights Reform in Israel, Gaza, and the West Bank, *Resource and Energy Economics*, 16, pp. 287-301.

Bliss, C., and B. Nalebuff (1984) Dragon-Slaying and Ballroom Dancing: the Private Supply of a Public Good, *Journal of Public Economics*, 25, pp. 1-12.

Bromley, D.W. (1995) Choices without Prices without Apologies, in: Daniel W. Bromley (Ed.) *Handbook of Environmental Economics* (Oxford UK and Cambridge, MA, Basil Blackwell).

Chaudry, M., and M.H. Siddigi, (1987) Toward a National Water Plan in Bangladesh, Chapter 34 in *Water Resources Policy for Asia*, in: M. Ali, G. Radosevich, A. A. Khan (Ed.) (Boston: A. A. Balkema).

Crow, B., with A. Lindquist and D. Wilson (1995) *Sharing the Ganges: The Politics and Technology of River Development* (Sage Publications, New Delhi).

Crow, B., and N. Singh (2000) Impediments and Innovation in International Rivers: The Waters of South Asia, *World Development*, forthcoming.

Dhillon, P.S. (1983) *A Tale of Two Rivers* (Chandigarh, Dhillon Publishers).

Dinar, A., and A. Wolf (1994a) International Markets for Water and the Potential for Regional Cooperation: Economic and Political Perspectives in the Western Middle East, *Economic Development and Cultural Change*, 43, pp. 43-66.

Dinar, A., and A. Wolf (1994b) Economic Potential and Political Considerations of Regional Water Trade: The Western Middle East Example, *Resource and Energy Economics*, 16, 335-356.

Economist, The, (1995-96), "Water in the Middle East: As Thick as Blood", 53-56, December 23rd - January 5th.

Fisher, F. M. (1995), The Economics of Water Dispute Resolution, Project Evaluation and Management: An Application to the Middle East, *Water Resources Development*, 11, pp. 377-389.

Friedkin, J. F. (1987) International Water Treaties: United States and Mexico, Chapter 25 in *Water Resources Policy for Asia*, in: M. Ali, G. Radosevich, A. A. Khan (Ed.) (Boston: A. A. Balkema).

Gazmuri Schleyer, R., and M. W. Rosegrant (1996), Chilean Water Policy: The Role of Water Rights, Institutions, and Markets, *Water Resources Development*, 12, pp. 33-48.

Grossman, G., and E. Helpman (1995a), Trade Wars and Trade Talks, *Journal of Political Economy*, 103, pp. 675-708.

Grossman G., and E. Helpman (1995b), The Politics of Free-Trade Agreements, *American Economic Review*, 85, pp. 667-690.

Grossman, S., and O. Hart (1986) The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration, *Journal of Political Economy*, 94, pp. 691-719.

Harsanyi, J.C., (1963), A Simplified Bargaining for the n-Person Cooperative Game, *International Economic Review*, 4, pp. 194-220.

Harsanyi, J. C., (1977), *Rational Behavior and Bargaining Equilibrium in Games and Social Situations* (Cambridge, Cambridge University Press).

Holden, P. and M. Thobani (1996), Tradable Water Rights: A Property Rights Approach to Resolving Water Shortages and Promoting Investment, World Bank, processed, February.

Iida, K., (1993) When and How Do Domestic Constraints Matter? Two Level Games with Uncertainty, *Journal of Conflict Resolution*, 37, pp. 403-426.

Just, R. E., S. Netanyahu, and J. K. Horowitz (1996) Water Pricing and Water Allocation in Israel, processed, University of Maryland, Department of Agricultural Economics.

Lax, D. A., and J. K. Sebenius (1991) Negotiating Through an Agent, *Journal of Conflict Resolution*, 35, pp. 474-493.

Mayer, F. W. (1992) Managing Domestic Differences in International Negotiations: The Strategic Use of Internal Side-Payments, *International Organization*, 46, pp. 793-818.

Milgrom, P., and J. Roberts (1992) *Economics, Organization, and Management* (Englewood Cliffs, NJ, Prentice-Hall).

Mo, J. (1995) Domestic Institutions and International Bargaining: The Role of Agent Veto in Two-Level Games, *American Political Science Review*, 89, pp. 914-924.

National Water Development Agency (1992) *National Perspectives for Water Resources Development* (New Delhi, NWDA).

Putnam, R. D. (1988) Diplomacy and Domestic Politics: The Logic of Two-Level Games, *International Organization*, 42, pp. 427-460.

Ramana, M.V.V. (1992) *Inter-State River Water Disputes in India* (Madras, Orient Longman).

Richards, A. R. (1994) Markets And Water: Getting There From Here, paper based on a presentation at the Conference, "Regional Cooperation in the Middle East", sponsored by The Institute on Global Conflict and Cooperation of The University of California, held in Vouliagmeni, Greece, November 4-7.

Richards, A. R., and N. Singh (1997) Two Level Negotiations in Bargaining Over Water, in: T. Parthasarathy, B. Dutta, J.A.M. Potters, T.E.S. Raghavan, D. Ray and A. Sen, (Ed.) *Game Theoretical Applications to Economics and Operations Research* (Boston, Kluwer Academic Publishers).

Rios Brehm, M., and J. Quiroz (1995) The Market for Water Rights in Chile, World Bank Technical Paper, no. 285.

Schelling, T. (1960) *The Strategy of Conflict* (Oxford and London, Oxford University Press).

Stiglitz, J.E., and A. Weiss (1981) Credit Rationing in Markets with Imperfect Information, *American Economic Review*, 71, pp. 393-410.

Tversky, A. and D. Kahneman (1990) Rational Choices and the Framing of Decisions, in: K. Schweers Cook and Margaret Levi (Eds.) *The Limits of Rationality* (Chicago and London, The

University of Chicago Press).

Williamson, O. E. (1975) *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization* (New York, Free Press).

Williamson, O. E. (1985) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting* (New York, Free Press; London, Collier Macmillan).

World Bank (1993) *Water Resources Management: A World Bank Policy Paper* (Washington, D.C., The World Bank).

Zeitouni, N., N. Becker and M. Shechter (1994) Models of Water Market Mechanisms and an Illustrative Application to the Middle East, *Resource and Energy Economics*, 16, pp. 303-319.

* We are grateful to Peter Kriz and Kathleen McDill for helpful research assistance, Ben Crow for useful conversations, and the University of California's Institute on Global Conflict and Cooperation for funding this research. All errors and shortcomings are our responsibility alone.

¹Fisher (1995) is, of course, more optimistic: "In the case of Israel, Jordan and the Palestinian entity, the value of the property rights at issue is small enough that it should prove possible to settle the issue in the context of a general peace agreement." (p. 381). Two paragraphs later, however, he states, "Note that we do not offer a specific solution for the issue of who owns the water". He goes on to focus on the value of water, independent of property rights. Our argument in this paper takes issue with the approach embodied in these quotes.

² Fisher (1995) does envisage "a water authority jointly operated by (at least) Jordan, Israel and the Palestinian entity" for monitoring compliance and "rational joint management of the water resources of the region" after ownership rights are established. We discuss this vision in the next section.

³This calculation is based on Fisher's figure of \$110 million in 1995, growing at a constant rate to \$500 million in 2020.

⁴ The housing market in India provides an example of the importance of understanding the nature of property rights to assets and of asset markets. Severe rent controls and other laws designed to protect tenants have not only distorted the rental market for housing, but also the markets for ownership and new construction.

⁵ Besides the work of Fisher, there are several other studies in the context of the Middle East, particularly Zeitouni, Becker and Shechter (1994) and Dinar and Wolf (1994a, b). While Fisher proposes joint management with model-determined transfers and prices, Zeitouni *et al* propose auction markets for priority claims. Dinar and Wolf explicitly introduce political concerns, using the tools of cooperative game theory (the Shapley value) to propose reallocations of water.