



Bringing Water Markets Down to Earth: The Political Economy of Water Rights in Chile, 1976–95

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Summary. — For 15 years Chile has been the leading international example of pro-market policies for water resources, and its 1981 Water Code has recently been touted as a model for other countries to follow. Water markets are controversial in both theory and practice: their potential benefits include greater efficiency and flexibility of water use and less state intervention and expenditure; while their drawbacks include social and environmental externalities, vulnerability to high transactions costs, and other common examples of “market failure.” No country has taken the experiment as far as Chile, since its Water Code privatized water rights, reduced state administration, and attempted to stimulate a free market in water rights. The results have been mixed and uneven. The lesson of the Chilean case is that setting up water markets is harder and more complicated than it may seem, even in the fairly simple arena of irrigation transfers. © 1997 Elsevier Science Ltd

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1. INTRODUCTION

Chilean water markets have enjoyed good press recently, shining in the reflected glow of the country’s dynamic economic growth. Influential voices within Chile and in the World Bank have praised the current Water Code, adopted in 1981, as a model of successful neoliberal reform, showing the benefits of privatization and free markets in water use and management. Neighboring governments — Peru, Bolivia, and Ecuador — have been encouraged by such voices, and in their admiration for Chile’s economy they are considering copying its water law as well. Unfortunately, the claims for the Water Code’s success are exaggerated or incomplete, resting on political or theoretical beliefs rather than empirical support. A closer look at the evidence shows the Code’s impact to be uneven, geographically diverse, and quite complicated: while some of its features have worked fairly well, others have had little effect and some have been negative.

The real lesson of the Chilean experience is that establishing markets in water resources is harder than it may seem. The Chilean case is unique because no other country has gone so far, for so long, in the direction of pro-market water laws. But despite the illusion of *laissez-faire*, markets are not simple, automatic, or self-maintaining mechanisms: how they operate depends on wider legal and

institutional frameworks, political and economic conditions, and geographic context. In the case of water these are often unfavorable or at least constraining. A balanced view of water markets would aim to take advantage of their benefits without exaggerating them or trying to wish away their flaws. Such a view characterizes much of the literature on water markets in the Western United States.

This article focuses on the areas where we might expect the Chilean Water Code to be most effective: reallocating water rights through private trading and improving the efficiency of water use, mainly within the agricultural sector. I begin by describing the Water Code’s key features and objectives, and the political and economic forces that shaped them. I then discuss the evidence that water market transactions in Chile are relatively inactive, followed by the range of factors that explain those results. After

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looking at the political debate stirred up by the government's recent proposals to reform the Code, I conclude with more general lessons and implications. I leave to a future paper my analysis of the areas where the Code has been much less effective: coordinating multiple water uses and relations among different economic sectors, resolving conflicts, and balancing externalities (environmental and third-party impacts). These problems underline the point that markets do some things well and others poorly, and despite their apparent neutrality they cannot substitute for overtly legal and political processes (Bauer, forthcoming).

2. THEORETICAL CONTEXT: TO MARKET OR NOT TO MARKET?

The pros and cons of freer markets in water rights have been much debated in recent years, first in the Western United States and then in international development circles. In their favor it is argued that markets increase economic efficiency by allocating resources to their most valuable uses. Different values are measured and compared by prices, and the way price signals coordinate dispersed information and preferences is one of the market's great strengths. For market forces to work, property rights to water must be legally defined as private, exclusive, and transferable — that is, as commodities like any other. Secure ownership is an incentive to invest in greater productivity, while freedom to exchange provides the flexibility to reallocate rights according to changing social demands and conditions. From this perspective the state should intervene as little as possible, protecting property, enforcing contracts, and reducing transactions costs and barriers to exchange. The state is blamed for much of current inefficiency, due to excessive regulations and subsidies which have distorted patterns of water use. Freer markets would “get prices right,” strengthening people's incentives to conserve as water demands increase, since they can sell any water saved.¹

More skeptical views hold that water markets are unable to overcome several major problems, classic examples of what economic theory calls “market failure.” Because water resources are so interconnected, private trading of water rights often affects other water users and/or the environment. Preventing or reducing such third-party effects requires laws and other social institutions, which necessarily limit free exchange. Because of these relations, and because water supplies vary in space and time, information is uncertain or costly and property rights are hard to define “clearly.” Some aspects of water resources are inherently “public” goods and involve collective interests, such as navigability or amount of pollution;

much of the infrastructure needed to develop and distribute water has features of “natural monopoly.” For all of these reasons transactions costs are generally high and property rights must be defined as conditional and overlapping rather than exclusive and alienable. Water problems involve such diverse interests, uses, and values that sorting them out relies on legal and political institutions more than markets.²

So complex a picture requires careful balancing of pros and cons. For this we need more empirical studies of how water markets actually work, and as already mentioned the Chilean case is remarkable for the relative purity of its free-market doctrine.

3. THE 1981 WATER CODE: PRINCIPLES AND OBJECTIVES

With its 1981 Water Code Chile's military government swung the pendulum away from the “statist” tendencies of the 1960s and 1970s, toward the opposite extreme. The Code was written and approved while neoliberal ideology in Chile was at its most ascendant, before being somewhat discredited by economic crisis.³ The Agrarian Reform Law of 1967 had included a new Water Code, greatly expanding state authority in water resources planning and administration (see following section). The 1981 Code aimed to reverse that trend by strengthening private property, increasing private autonomy in water use, and favoring free markets in water rights to an unprecedented degree. It creates several market mechanisms and attempts to foster a market mentality among water users. As a corollary it sharply reduces the state's role in water management and regulation.⁴

Nevertheless, the 1981 Code's market logic has some inconsistent features, reflecting compromises reached after years of bitter debate within the military government and among its civilian advisors and supporters. While nearly everyone agreed that private property rights to water had to be strengthened, they disagreed over how far this should go and particularly over how closely to follow free market economic theory. In this sense the conflict over water rights mirrored the deeper conflict within the government over neoliberal policies in general. There were essentially two positions: the neoliberals (nearly all economists) favored fully adopting the market model, but were opposed by more conservative elements within the armed forces, the agricultural sector, and the state's irrigation bureaucracy. Agriculture has historically been the dominant water use in Chile, and it was the sector most concerned with reforming the previous Water Code.

Formally, the new Code declares that water is public property, to which the state can grant private

rights of use. In substance, however, the Code strengthens private control over use-rights in several innovative ways. Water rights are now completely separate from land ownership — for the first time in Chilean history — and can be freely bought, sold, mortgaged, and transferred like any other piece of real estate. The state water rights agency is the National Water Directorate (*Dirección General de Aguas*, or DGA), which grants requests for new rights free of charge whenever there is water physically and legally available. But once constituted all water rights are governed by private or civil law rather than public or administrative law; they are subject to the general system of real estate title registration, and are fully protected as private property in the 1980 Constitution. The Code also recognizes all rights granted or acquired under previous laws. In theory all water rights must be measured in terms of volume per unit of time (e.g., liters per second), but in practice many are expressed as shares of canals.

Private liberties are wide and state authority constrained, compared to earlier legislation. Rights-holders can freely change the locations and types of uses of water rights without administrative approval by the DGA (except when changing the location of diversions from a natural water-course). Applicants for new rights no longer have to specify nor justify their intended uses to the DGA, which has no discretion to deny such requests if there is water available, nor to decide among competing applicants (earlier legislation had established a list of different water uses in order of priority). If there is not enough water to satisfy simultaneous applications, the DGA must hold a public auction and sell the new rights to the highest bidder. Rights-holders pay no taxes or fees, neither for acquiring rights from the state in the first place nor for keeping them over time. But unlike earlier laws they now have no obligation to use their rights, and face no penalty nor risk of cancelation for lack of use; such measures were left out of the Code as invasions of private liberty. (In most countries water law includes some requirement of “beneficial use,” as it is called in the Western United States.) Taken together these provisions allow unregulated speculation in water rights.

The DGA, for its part, now has little authority over private water use (except during official drought emergencies). Most water management decisions are made by private individuals and especially by private canal users’ associations, which have a celebrated tradition in Chile of building and operating canals and distributing water rights.⁵ The DGA cannot cancel or restrict water rights once granted or recognized, except by expropriating and paying for them. It has also lost its adjudicatory powers over water use conflicts to the ordinary courts. Nonetheless, the agency retains several

important technical and administrative functions, such as gathering and maintaining hydrologic data; inspecting larger water works such as dams and canals; enforcing the rules governing private water users’ organizations; and keeping official (though incomplete) registries of water rights and of users’ organizations. The DGA can also prepare studies, plans, and policy recommendations, but these have no regulatory force unless approved by other branches of government.

The Code does not mandate or establish a market in water rights, but tries to set up the legal preconditions for such a market to emerge spontaneously. Market logic is evident both in the procedures for public auctions and in the incentives created for private investment in more efficient water use, in order to sell the rights to the water saved. It shows more generally in the Code’s core principle of private initiative and autonomy in decisions about water use. This principle is not confined to the freedom to trade rights, but also applies to coordinating multiple water uses within river basins: irrigation, hydroelectricity, industrial and domestic uses, etc. While the Code does not expressly address multiple-use issues, it leaves them to be resolved by voluntary negotiation and bargaining among private users and users’ organizations, with the courts having the last word in case of conflicts.⁶

4. LEGAL AND POLITICAL BACKGROUND: AMBIGUITY AND CONTRADICTION

Chile passed its first Water Code in 1951, systematizing a century of piecemeal and local law-making since the Civil Code of 1855, while affirming its ambiguous notions of ownership of water (which in turn echo Spanish colonial law). The Civil Code declared most waters to be “national property of public use,” a label they have kept to this day. In principle such property can never leave public ownership, though the state can grant private rights to use it; such use-rights are administrative concessions rather than private property, and hence can be revoked without compensation. Some categories of waters were recognized as private, the most important of which were those flowing in artificial canals. The 1951 Water Code kept these definitions, establishing a more formal administrative procedure for granting use-rights, but once granted they became treated as private property and could be registered in local Real Estate Title Offices (*Conservador, de Bienes Raices*). Despite this strengthening of private rights they were subject to many legal conditions — they were still tied to land ownership and their owners were required to actually use the water — and the state had wide regulatory authority.⁷

The pendulum swung farther toward state control

with the controversial Agrarian Reform Law of 1967, during the reformist Christian Democratic government of Eduardo Frei Montalva. The Agrarian Reform aimed to expropriate and redistribute large landholdings with the twin purposes of expanding the class of small landowners and modernizing agricultural production (Garrido *et al.*, 1990; Jarvis, 1985, 1988). Since this required redistributing water as well, the law included a new Water Code and was accompanied by a constitutional amendment which declared all water rights to be public property. They were expropriated without compensation, reverting to the status of administrative concessions. The Code also created a new state agency, the DGA, with expanded powers, which was thought necessary to increase the efficiency of water use. The DGA was to set technical standards of "rational and beneficial use" based on local land use and geographic conditions, and reallocate water rights according to these and other planning criteria; private transactions were illegal. The DGA was also given adjudicatory power over water use conflicts.⁸

Such a technocratic system would have been hard to implement under the best of circumstances. During 1967-73, however, the growing radicalization of the Agrarian Reform and polarization of Chilean society and politics in general made land tenure too unstable to reallocate water use. The military coup in 1973 put an end to land expropriation, and the military government soon began to "normalize" the agricultural sector. This involved fortifying private property rights, confirming individual titles to expropriated land, encouraging an agricultural land market, and reducing the state's role in production; the larger context was the switch to neoliberal policies in the economy as a whole. But for over five years the government left the Water Code in place and the water rights situation unresolved, a secondary priority. By the late 1970s the result was a mess: a state-centered water law in an incompatible, market-oriented political and economic order. The legal insecurity of water rights discouraged private investment in water development or management, and the system's inflexibility prevented transfers to higher-valued uses. Water rights titles were especially uncertain because after 1967 neither they nor their transactions were recorded in official property registries, since the second Water Code considered them merely administrative concessions.

In the mid-1970s most members of the government and its civilian advisors agreed that water rights needed stronger protection as private property, but they were deeply divided over how extreme or pro-market the reform should be. At first the more traditional conservatives had the upper hand, when in early 1976 the government-appointed Constitutional Commission took up the issue in its more general

discussion of property rights. The Commission members were all lawyers. Advised by prominent irrigation engineers, they essentially wanted to return to the 1951 Water Code, combining private rights and state regulation. They recommended adding explicit mention of water rights to the Constitution's articles on property. Their main argument was that greater legal security would spur owners to invest in building and maintaining irrigation canals, and revitalize the dormant canal associations. They were far from pro-market, emphasizing the public aspects and obligations of water use and rejecting a proposal to allow water rights to be sold separately from land. But even this position was too liberal for some nationalists within the military, and the Commission's proposal was shelved for several years.⁹

The pendulum finally swung back in 1979, when the neoliberals had risen to dominate government policy. The government dictated the strongly pro-market Decree Law 2,603, the foundation for the new Water Code two years later. The Decree Law had two chief objectives: first, to privatize water rights and so prevent the risk of indirect state intervention in land tenure, and second, to create economic incentives for private investment in water development, in order to avoid the need for state funding. The new law separated water rights from land ownership for the first time and allowed them to be freely bought and sold. It added water rights to the Constitution and reestablished the system of registering them in Real Estate Title Offices. It also attempted to regularize the uncertainty of existing titles by declaring a presumption of ownership in favor of those who were currently using water rights *de facto*, and by proposing to hold public auctions for all expired or cancelled rights.

A major innovation was that like other real estate water rights were to be taxed, giving them a real cost to their owners. (Water and land were to be appraised and taxed separately, with the total not exceeding the taxes formerly paid on the irrigated land. Under the existing system water rights were taxed indirectly through land taxes since irrigated land was assessed at higher values, but these taxes were and remain quite low.) The economists argued that these policies would boost conservation and efficiency, encouraging rights-holders to think about and manage water as a commodity and an economic good, rather than a free attribute of land ownership. With higher water prices rights-holders would invest in better irrigation technology, in order to sell the rights to the water saved and lower their tax burden. This would shift water to more highly-valued uses, both within agriculture and in urban and industrial sectors.¹⁰

The market logic of Decree Law 2,603 and the 1981 Water Code was fiercely debated within the government, and diluted as a result. The original version of the Decree Law was even more pro-

market, with sweeping claims about the benefits of fully commoditizing water rights.¹¹ In a meeting with the governing Junta in February 1979, the Ministers of National Planning and of Agriculture explained the problems caused by the 1969 Code and defended the market logic of the proposed law. They emphasized that along with privatizing rights the crucial element needed for the new logic to function was the mechanism of separate water rights taxes, in order to give water a real cost and create the incentive for its efficient use. But several military lawyers present were concerned about the familiar issue of public ownership and warned that the property status of use-rights was not clear.¹² The law that emerged two months later was missing the strongest pro-market language.

The neoliberal argument was also opposed by many Chilean water experts, who were and still are overwhelmingly engineers or lawyers. Whatever their politics, their training and experience led them to place more emphasis on the public character of water than did the economists. But the main opposition came from agriculture, the country's biggest water user — with the Agrarian Reform fresh in their minds, farmers and landowners were much more concerned about private property than market efficiency. The National Agriculture Society and the Confederation of Chilean Irrigators welcomed the new laws with the same argument used by the Constitutional Commission three years earlier: secure private rights would boost investment, but buying and selling would be minimal. While in principle they supported the freedom to change rights and uses without state interference, in practice they expected few transactions and little reallocation to take place.¹³ This helped sink the proposal for water rights taxes. The agricultural sector was financially weakened from years of adjustment to the new economic model, and refused to start paying for a resource which had always been free.

Thus the 1981 Code was a compromise between neoliberals and their more conservative opponents, who agreed on strengthening private property but not on applying market economics. The neoliberals got most of what they wanted: a permissive legal framework allowing private market transactions, and a weak state. (The close connection between water rights reform and state irrigation policy is shown by the fact that the new Code (D.F.L. 1,122) was accompanied by D.F.L. 1,123, published the same day in the *Diario Oficial*, which established the norms for financing state irrigation projects; those norms were so demanding that while they were in force no state projects were approved. In 1985 the government passed Law N.18,450 to subsidize small- and medium-scale private irrigation projects, discussed below.) They gave up the financial measures (taxes or fees) that would have raised

water's cost, which they had thought crucial to fostering market discipline and efficiency. Instead they hoped there would be enough trading that markets would take shape, determine prices, and guide reallocation of resources. As we will see in the following section, however, the results have been fairly modest.

5. THE WATER MARKET IN PRACTICE

Sales and transfers of water rights that are separate from land are uncommon in most of Chile. While they take place routinely, they involve a very small percentage of water users and relatively little reallocation of resources, and the resulting markets are fairly inactive. There are local exceptions to this generalization, especially in the desert North, but they depend on such unusual conditions that they tend to confirm the larger argument. These are not the results I expected to find: when I began my fieldwork I interviewed many people about their experiences of the positive and negative impacts of the water market, only to hear time after time that they could tell me little because there was no such thing. Eventually I realized that the real question was why was the water market so limited?

This assessment was shared by the great majority of many dozens of people interviewed, both in local study areas and at the national level. They included farmers; the engineers and administrators of the more important private canal associations; state functionaries in the local, regional, and national offices of various agencies in the Ministries of Agriculture and Public Works (including the DGA); staff of the local Real Estate Title Offices; lawyers working in water rights; staff of nongovernmental organizations working in agricultural and rural development; university professors; and experts in United Nations organizations. The consensus is remarkable considering the diversity of these observers' experiences and political views: many people with conflicting opinions about whether a water market is desirable have similar perceptions about how limited it has been in practice. There are some dissenting views claiming that the market has been active which are discussed below.

Reliable information about water rights trading in Chile is still scarce. There is only anecdotal evidence of rentals or other informal transfers; they are said to be common between neighbors, but this has always been true and is not due to the current Water Code. Sales of water rights are recorded in Registers in local Real Estate Title Offices. The first empirical study using this data was published in 1993, 12 years after the Code's passage (Bauer, 1993), and since then there have been several more. (Problems of

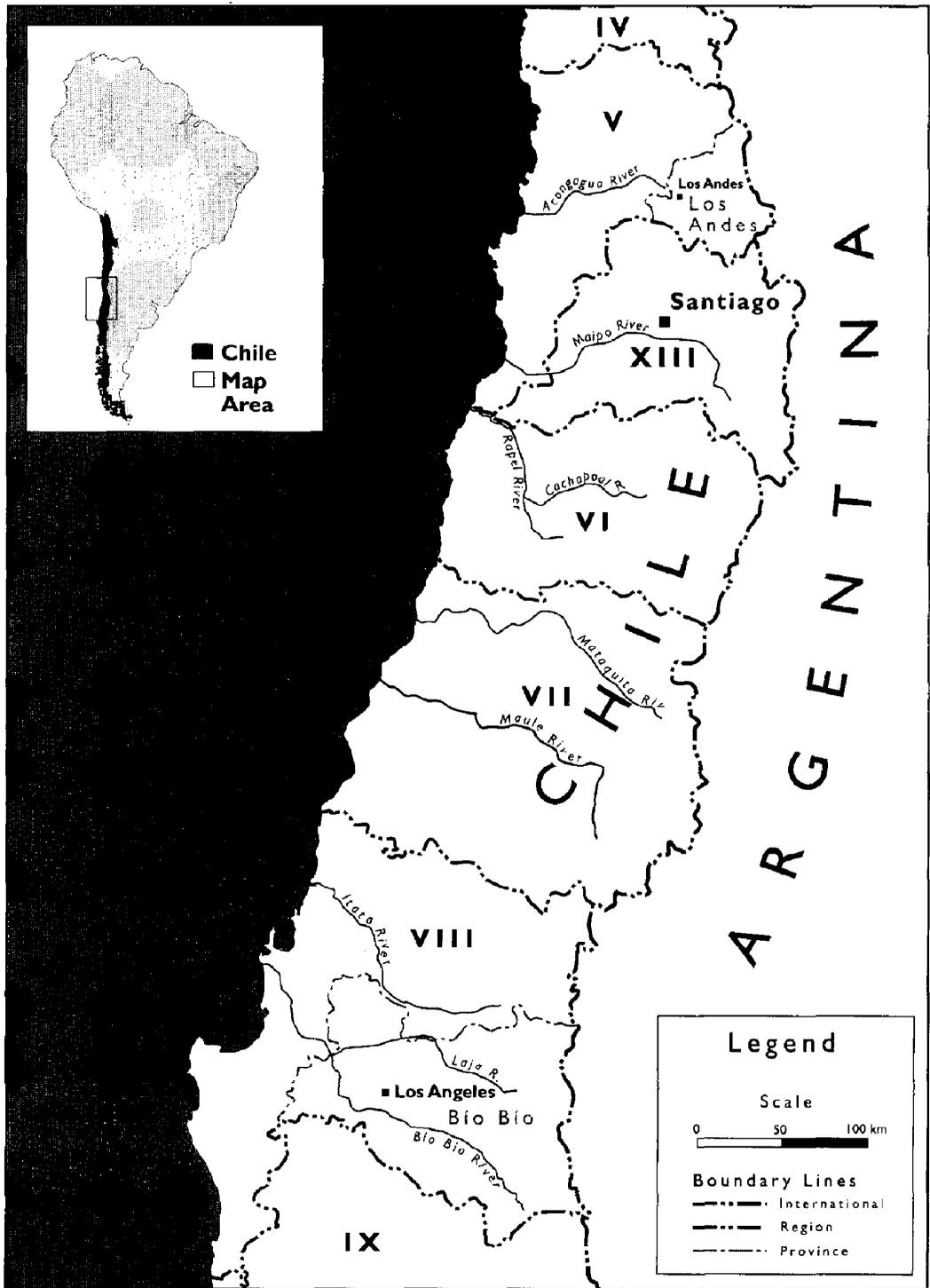


Figure 1. Central Chile.

uncertain title are discussed in the following section.)

Bauer (1993, 1995) describes two study areas at the northern and southern ends of Chile's central valley system, the nation's agricultural heartland (see Figure 1). They represent the contrasting subdivisions of Chilean agriculture, traditional and export-oriented (Gómez and Echenique, 1988). The traditional sector produces annual crops and livestock and dairy products for the domestic market; it includes most *campesino* farmers but also larger commercial operations using modern agricultural technology and chemicals. This sector dominates central and southern Chile and has been in precarious economic shape for many years, worsened by opening the borders to international competition in the late 1970s because the country's comparative advantage is in mediterranean products. The export sector is more modernized and dominated by fruit production, located in the center and north, and has been more dynamic and prosperous in the past 20 years. The difference in crop patterns is largely due to climate, which gets colder and wetter as one goes south in Chile, causing lower yields and forcing cultivation of lower-value crops until agriculture gives way to livestock grazing and forests.

Traditional agriculture is represented by the Province of Bío Bío in south-central Chile (Region VIII), in the Bío Bío River basin. With rainfall abundant but seasonal, the Province has 175,000 hectares of irrigated land (about 10% of the national total), watered by nine major canal systems built wholly or partly by the state. Local levels of irrigation technology and practices are low, and have not changed for many decades: water use efficiency averages about 20–25% at the farm level. There are well over 10,000 irrigators and canal users producing grains, peas and beans, industrial crops (oilseeds and sugar-beets), and pasture. Its largest *comuna* (township or county), Los Angeles, has over a third of the Provincial total: several thousand irrigators and 65,000 irrigated hectares. In this area during 1980–91 there were about 150 sales of water rights separate from land recorded in the Los Angeles Real Estate Title Office, averaging 13 per year. This amounted to 20% of the total water rights sales recorded, since the rest simply accompanied land in land transactions. The staffperson in charge of maintaining these records described separate water rights sales as “*pocísimas*” (very few), which was echoed by the administrators of local canal associations.¹⁴

A contrasting case is the Province of Los Andes in the upper Aconcagua River basin (Region V), just north of the capital city of Santiago. This Region is hotter and drier and for many decades has had some of Chile's most highly capitalized agriculture and agro-industry. Fruit production (mainly table grapes) has expanded steadily since the 1960s — 15 years

before the rest of the Chilean “fruit boom” — replacing annual crops to reach a Regional total of 30,000 hectares in 1990 (20% of the national acreage in fruit). Since 1975 there has been an active land market, fueled by the boom in fruit exports and the resale and consolidation of many *parcelas* resulting from the Agrarian Reform (Korovkin, 1992; Rodríguez and Venegas, 1989). These changes were often accompanied by major investments in modern irrigation technology at the farm level. In Los Andes Province (including the neighboring *comuna* of Santa María) there are 25,000 irrigated hectares, the great majority in fruit plantations, watered by 27 canals and 5,400 irrigators (Dirección General de Aguas, 1993b). In the same 1980–91 period, there were about 275 separate water rights sales, averaging 23 per year — nearly twice as many as in Los Angeles, with about one-third of the land area. The higher frequency is presumably due to the more intensified local agriculture and the higher value of water. Even so, it seems a fairly marginal reallocation of resources for such a dynamic area, and as in Bío Bío Province local experts agree that sales are uncommon.

Grants of new permanent water rights have had a minor impact on local water markets, because in central and northern Chile most available rights to surface-water had already been appropriated by the 1980s. In Bío Bío Province the DGA granted 44 new consumptive rights in 1982–92, five of them for groundwater. In Los Andes Province it granted 26, 18 of them for groundwater.

Subsequent research has confirmed these results. Hearne (1995) studied four areas in central and northern Chile, all chosen because they were expected to have active local water markets, based on prior information. Although he concluded that there had been gains from trade, in three of the four areas he showed that transactions were very limited: the Maipo River basin in central Chile (including the Santiago metropolitan area), the Elqui River basin 400 kilometers to the north,¹⁵ and the Azapa River basin near the Peruvian border. The exception was the Limarí River basin, located between the Maipo and the Elqui, where active water rights trading is facilitated by the existence of three large storage reservoirs (built by the state) and well-organized canal associations. The reservoirs allow banking and transfer of specific volumes of water, which as we will see below is rare in Chile. The Limarí case is widely considered the country's most successful example of a functioning water market (e.g., Confederación de Canalistas de Chile, 1993).

Most Chilean experts with a national perspective agree that transactions are few in most of the country. In the public sector this includes the last three heads of the DGA, covering the entire period since 1981, as well as the current head of the

Irrigation Directorate.¹⁶ Since 1993 both of these agencies have undertaken empirical studies of water markets, whose results apparently concur (the Ministry of Public Works is to release the results in 1996). Even the President of the private sector's Confederation of Chilean Irrigators, an avowed proponent of the water market, agrees that so far trading has been limited (in fact that is his argument for rejecting some people's criticisms that the market has caused negative externalities). He claims that trading has increased in the past few years but admits there are no data to prove it (Peralta, 1995).

Some recent publications — several of them associated with the World Bank — have made the opposite argument, claiming that Chilean water markets have been active and have successfully delivered many of their promised benefits. The efficiency and technology of water use have improved, private investment has increased, waters have been significantly reallocated within agriculture and to other uses, conflicts among users have declined, and poor farmers are better off. Unfortunately, many of these arguments consist of confident assertions with little supporting evidence; they are either highly debatable or simply unfounded. There is clearly room for different interpretations of how "active" or "effective" the market has been, but some of these claims are so sweeping that they are best understood as political or theoretical statements rather than balanced or empirical analysis.¹⁷

The great majority of water rights transactions that do take place are between irrigators, within the agricultural sector. Sales from one sector to another — i.e., transfers from one type of use to another — are more uncommon. They occur in two different situations. The first is where cities have expanded into rural areas, particularly in the case of Santiago but also in some smaller cities to the north. The second situation is also particular to the north, where a sustained mining boom has increased demand for water and mining companies have bought rights from farmers. This is highly controversial in some areas where it threatens local agriculture with extinction, especially where indigenous communities are affected. In general, however, intersectoral relations have been more concerned with coordinating multiple uses than with market transfers (Bauer, 1995).

6. WHY TRADING IS LIMITED

Why have water rights sales separate from land been so limited in Chile? The answer is that a range of factors discourage them by raising obstacles and transactions costs. Many of these are similar in most parts of the country, and include limitations imposed by physical geography and infrastructure; legal and administrative complexities; cultural and psycholo-

gical attitudes; and ambiguous or contradictory economic signals of price and value (i.e., indicating that water's value is both high and low). Some of these obstacles might be overcome by changes in law and policy, or by increasing water scarcity over time; others are unavoidable. In addition, while many of the details are particular to Chile, the same general factors are found in other countries.

(a) Geography and infrastructure

Chilean geography strongly influences the potential for transferring water. Most of the country's irrigated land is in the narrow central valley, which begins at the Aconcagua River basin and runs south for hundreds of miles between the low coastal mountains to the west and the high Andes to the east. It is divided from north to south into a series of fairly small, steep river basins separated by hills, with rivers plunging from the Andes westward to the sea in a mere 100 miles. It is hard and expensive to move water from one basin to another, or from downstream to upstream areas within the same basin. The Andean snowpack helps agriculture by providing natural, short-term water storage, substituting for artificial reservoirs. Snowmelt begins every spring and continues till late summer, filling the rivers through most of the irrigating season. As a result, irrigation systems have been built and operated around diverting water from unregulated rivers, whose flows change daily, seasonally, and annually. This has also had a major historical influence on water law and administration. Water rights are traditionally defined not as specific quantities but as proportional shares in whatever amount of water is available at a given time.

Existing infrastructure is generally too rigid or otherwise inadequate to redistribute much water (Livingston, 1993). Chile has few medium to large reservoirs, and only one big enough to store more than a year's flow (Lake Laja in the Bío Bío River Basin). Some of them are shared between irrigators and hydroelectric users, although their seasonal water demands conflict. For most canal systems the key structure is the *bocatoma*, the barrier that diverts water directly from the river's edge to the head of the canal. They are typically temporary works rebuilt every year, made of stone, wood, brush, etc. Where there are more permanent concrete structures, they have been designed to divert specific volumes or proportions of flow, and are often hard to convert to different specifications. Within canal systems most distribution works are also inflexible. Flow dividers (*marcos partidos*) are fixed barriers that divide the flow of larger canals into smaller secondary canals, according to their water rights, thereby distributing constant proportions of varying flows. As a result

most transfers of rights from one location to another require modifying all of the intervening flow dividers, in order to ensure that the water corresponding to third-party rights is delivered unaffected. These changes are often prohibitively expensive, except between nearby members of a shared canal. (A related cost is the payment necessary to the owners of any canals used to transport water to its new destination, unless both parties to the sale are members of the same canal association.) Finally, since most canal works are crudely constructed and poorly maintained, it is hard to be precise about changing distribution. (The description in CEPAL, 1960 is still accurate in many areas.) There are special problems on many parcels resulting from the Agrarian Reform, since canal systems originally built for large farms are usually inadequate to deliver water to many smaller ones.

(b) *Legal and administrative factors*

The principal legal obstacle to trading is the continuing uncertainty of many titles. In theory, under the 1979 Decree Law and the 1981 Water Code, all water rights must be registered in local Real Estate Title Offices. But the Code also recognizes all rights granted or acquired under earlier legislation, going back to the 19th century; few of these have ever been registered, and even fewer updated after changing hands in land transactions or inheritances. (Recall that registering water rights was not required until the 1951 Water Code, and was then abandoned by the 1967 Agrarian Reform Law.) In addition, historically water use in the Chilean countryside has been characterized by situations of fact more than formal law (Agurto, 1988; Escudero, 1990; Stewart, 1967). The military government addressed the problem by favoring the present users of water (in 1981), declaring a presumption of ownership in their favor and creating special procedures in the Code's Transitory Articles to "regularize" titles, even if the rights had been registered before to someone else. One such procedure dealt with the water rights associated with land in the Reform sector.

Many more water rights have been regularized than bought or sold.¹⁸ Since 1990 (when the present civilian government came to power) the DGA has encouraged regularization as part of its program to form water users' organizations, with partial success. Part of the incentive is that unregistered rights cannot be bought, sold, or mortgaged. The higher courts have somewhat undermined the policy by giving unregistered rights full constitutional protection as property, insisting that they are not lost through failure to be registered (and even suggesting that rights which were once registered cannot be

regularized to someone else, even if unused for decades). Thus in many areas there are an unknown number of legally valid rights which in theory could be asserted at any time.¹⁹ The uncertainty obviously discourages both transactions and investment, a problem which has gotten more attention in recent years as the government has tried to marshal its arguments for reforming the Water Code.

Possible transactions are also hindered by the uncoordinated system of record-keeping, and by information that is costly or hard to obtain. There are three sources of information about water rights ownership. The only one legally definitive is the Water Rights Register of the Real Estate Title Office. These Offices are local in coverage (about the size of a *comuna* or township), and the information is not compiled or systematized at the provincial, regional, or national levels. In different canals a share (*acción*) corresponds to a different amount of water, but such discrepancies are sometimes overlooked when transfers between them are recorded in the official Registers. Second, the most accurate and up-to-date sources are often the records of the private canal associations, with respect to their own members, but they do not count as proof of title. Third, the DGA keeps its own Water Rights Registers and is trying to expand them, but they are still very incomplete. They include only the rights initially granted by the state (not those constituted under earlier laws), with no information about their subsequent transfers.

A final administrative obstacle is the need to protect third parties from injury, as the Code requires. There is no agency that reviews all transfers. Water rights holders affected by someone else's change or transfer of use can protest either to the canal associations involved or to the civil courts. The DGA must approve changes in the locations where water is diverted from a natural stream, but otherwise has no authority to intervene in or settle water conflicts. That power belongs only to the courts, if requested by an injured rights-holder. Because Chilean judges are rarely competent in technical aspects of water rights, and because the legal system is overburdened, these procedures tend to be slow and erratic. Even if they were streamlined, however — by better combining legal authority with technical expertise — they would remain a restriction on free transfers.

(c) *Cultural and psychological attitudes*

Strong cultural and psychological influences in the countryside also hinder water rights sales. It would be hard to exaggerate the real and symbolic importance of irrigation in this semi-arid country, where it has taken centuries of labor and willpower

to bring water to dry lands and transform them into productive fields. Spanish irrigation traditions have predominated, due to the long colonial rule and to the fact that central Chile's mediterranean climate is so similar to Spain's. This history joins the constant threat of drought to reinforce Chilean farmers' ingrained determination to hold onto their water supplies at almost any cost. They resist selling water rights and returning land to its original non irrigated condition. In addition, many water users, especially small farmers and in more traditional areas, are still ignorant of the new Code's provisions, and continue to manage water as did their grandparents. As one expert explained, "In Chilean irrigation the weight of history is heavy."²⁰

In other words, despite the explicit intent of the current Water Code, many people continue to believe instinctively that water rights should not be bought and sold separately from land, nor treated as simply another commodity (Brown *et al.*, 1982; Brown and Ingram, 1987; Maass and Anderson, 1978). Some argue that market logic is inappropriate in the case of water precisely because it is so vital and scarce. It is common to hear emotional comments that "water is life," too fundamental to human existence to be entrusted to commercial motives. This view evidently contradicts the neo-classical economic argument that it is the very scarcity of resources that makes it important to allocate them efficiently, via the market — neoliberalism has not yet succeeded in "modernizing" traditional agricultural and other mentalities in Chile. It is hard to measure the weight of these cultural factors, but they clearly affect people's responses to price signals and market incentives.

(d) *Prices and value*

Faced with all of these obstacles and transactions costs, a market can arise only if the value of water is fairly high. The economists who designed the Water Code expected prices to rise once water rights were made freely alienable, driven by increasing urban and industrial demand in a developing economy. As water rights were transferred out of agriculture, farmers would be forced to irrigate more efficiently with their remaining supplies, and some would shift to higher value crops. But it has not worked out that way in practice: price signals remain uncertain, ambiguous, or contradictory in much of the country, indicating that water is simultaneously cheap and valuable. Presumably the water market's relative inactivity helps prevent it from straightening out these discrepancies [see Saliba and Bush (1987) for a similar analysis of the Western United States].

"The value of water is much higher than its price," as one lawyer put it.²¹ Most farmers who

want to keep farming refuse to sell even a fraction of their water rights. They have strong economic motives, in addition to the cultural attitudes already mentioned. Without its water supply land from northern to south-central Chile loses most of its productivity and its value drops sharply: in the central valley irrigated land is worth from three to 10 times as much as non irrigated land. In theory the price of water rights should be equivalent to the difference between the two, or in other words should be nearly as high as the price of irrigated land. In practice buyers have rarely offered this much without including the land. This helps explain why most water rights sales are still part of land transactions, since sellers have little incentive to hold onto land without water. People willing to sell water rights separately tend to be getting out of agriculture, disposing of inheritance, or economically desperate. It appears an irreversible move, since there is no guarantee of being able to buy rights at an affordable price in the future.²²

Nor have potential buyers offered prices high enough to compensate for water rights' value as "drought insurance." In Chile's mediterranean climate dry years are frequent but unpredictable, and cause major crop losses. Since water rights are typically defined as proportional shares rather than fixed quantities, the only way to have secure supplies during a drought is to hold excess rights in reserve the rest of the time. This is especially critical for orchards and other permanent crops, where the investment at stake is much greater than losing a single year's production. In normal and wet years people let their reserve rights flow by unused, benefiting non-owners downstream, but they are not "surplus" nor available for sale.

Finally, many owners of water rights refuse to sell because they are speculating. All signs are that water's value will rise in the not-too-distant future, which is a strong incentive to simply hold onto existing rights even if they are not currently used to produce anything. It is obviously easier to do this indefinitely when the law imposes no financial obligations such as taxes or fees, nor legal duties such as requiring "beneficial use" (a "use it or lose it" doctrine). Speculation has been one of the Code's most controversial aspects in Chile, criticized across a wide range of the political spectrum and defended mainly by staunch neoliberals. In the hydroelectric sector (i.e., with nonconsumptive water rights) it seems to have had a significant impact on development, but in agriculture the concern has been exaggerated.

Why don't buyers bid up the prices enough to convince sellers, then, if water rights are so valuable? Partly because the transactions costs are so daunting, and partly because in fact water is not yet as scarce in most of Chile as popular myth would

have it. Those who need water and have the means to pay for it have cheaper alternatives than buying existing rights, or they simply buy land with associated water rights.

In the first place, if they already have any water rights they can increase their available supplies by investing in more efficient use (with a national average irrigation efficiency of about 25%, there is plenty of room for improvement). The water saved is for their own use for expanding irrigation, and is not for sale. Second, they can pump groundwater. This has initial costs for well-drilling and equipment, and energy costs over time for pumping, but supplies are still abundant and relatively untapped in central and southern Chile. In recent years there have been growing numbers of applications for new groundwater rights and rising rates of extraction. Third, people can apply for and store new "contingent" water rights (*eventuales*) and build storage capacity. "Permanent" rights have first claim on available water, and can be allocated until they total the average flow of a river or stream, which the DGA then declares "exhausted" (*agotado*). But the DGA can continue to grant "contingent" or secondary rights to any waters that remain after permanent rights have been satisfied (the distinction is similar to junior and senior appropriation rights in the Western United States). Since these temporary surpluses typically happen only in winter and spring, when flows are highest and agricultural demand is lowest, owners of contingent rights must build storage works if they want to use the water during the summer growing season. Although any of these options may be cheaper than buying water rights, they are evidently beyond the reach of *campesino* farmers.

A low value for water would also help explain why market incentives to conserve have been so ineffective. Despite expectations to the contrary, there has been almost no private investment in irrigation technology for the purpose of selling rights to the water saved. In most of central and southern Chile, including Bío Bío Province, water use efficiency remains at its traditional level of 20–30%, with flood irrigation the dominant practice. In the Aconcagua Valley and other fruit zones near Santiago, on the other hand, many landowners have installed expensive modern drip-irrigation systems, raising efficiency at the farm level. But they have been motivated by agronomy and economy, not by scarcity of water: fruit plantations are much more productive, and make better use of other inputs like fertilizers and pesticides, when irrigated with small but carefully controlled amounts of water. In addition, after the initial expense the costs of labor, operation, and maintenance are lower. These factors make the investment worthwhile for many irrigators — along with the government subsidies mentioned below — and despite high costs to repay they rarely

sell any rights to the water saved. They let the surplus flow by, but they hold onto the rights for the reasons discussed above.²³

The biggest private sector irrigation interests recognized the failure of the Code's market incentives several years after its passage, although they downplayed its political significance. The National Agriculture Society and the Confederation of Chilean Irrigators argued that private investment had been much lower than expected and convinced the government to pass a new law in 1985 (Law N.18,450), providing eight years of state subsidies for building or improving small- to medium-scale private irrigation projects. (Recall that five years earlier these two organizations' principal argument in favor of the new Code was the boost that legal security would give to private investment, while they expected little from the water market.) This law has been widely supported in the agricultural sector, despite some criticism for favoring more prosperous farmers, and in 1993 it was extended for another eight years (Confederación de Canalistas de Chile, 1986, 1989; GIA, 1986). It may well be a good policy, but it would not have been necessary if the incentives for private investment had worked as well as they were supposed to, or if water's price had been higher.

A final example of constraints on market mechanisms is the fate of public auctions of water rights, which the Code requires when there are simultaneous applications for the same water. These auctions have been very rare in practice. In the early 1980s the DGA auctioned some rights in the upper Mapocho River, near Santiago, mainly to try to generate information about prices in a non-existent market; the agency's head at the time emphasized that prices would not be accurately determined until markets became sufficiently active. Later the military government intervened directly to prevent auctions in several cases with intersectoral implications, particularly involving hydroelectric projects. The government was unwilling to leave such crucial allocative decisions to the free market, and either denied the applications or simply assigned the rights to the applicant preferred on the basis of "exceptional circumstances and general interest" (Article 148, Water Code). Thus the same government that promoted the water market also exercised its power to make directly political decisions about allocation when it seemed important.

7. PEASANT FARMERS AND THE WATER MARKET

Most peasant farmers (*campesinos*) lack secure water supplies or legal title to water rights. Their canal infrastructure is generally cruder and not well

maintained, and they have a weak voice in local canal associations, which tend to be run in the interests of larger farmers. Peasants are unable to assert or defend adequately their interests in conflicts over water use: they are handicapped by lack of the social influence and resources needed to navigate successfully the formal legal and administrative system, which they prefer to avoid dealing with. This makes it harder to find good information about their situation, especially because until recently water rights received little attention from either the government agencies or nongovernmental organizations that work in small-scale agricultural development.²⁴

These problems, of course, have deep historical roots and reflect peasants' overall poverty and social position more than recent changes in water law (Echenique and Rolando, 1989). But the new Water Code seems to have made them worse off in several ways. First, the mere fact of an abrupt legal change — whether market-oriented or not — caused problems for people who were slow to be informed or marginalized from the legal and governmental system. In the 1980s the government undertook no campaign of public information or education about the Code's new features, nor offered legal or technical advice about how to apply for new rights or regularize old ones. By the time peasants and their organizations learned of the new procedures, available water rights in many areas had already been granted by the DGA or regularized by those more legally adept. (An important exception is the case of the *parceleros*, the beneficiaries of the military government's subdivision and privatization of lands expropriated in the Agrarian Reform. *Parceleros* are generally the better off of small farmers in Chile. In 1985–89 the government funded consultants whose reports assigned and regularized the water rights attached to the expropriated land.)

Secondly, *campesinos* lack the essential prerequisite for entering the market to acquire water rights — money. To benefit from the water market they depend on current owners increasing efficiency and making available enough water to lower its selling price, which so far has not happened. They are probably the group most injured by others' speculating in or hoarding unused rights, since it denies them secure access to waters that they see flowing by, physically available. Since 1990 the two governments of the *Concertación* have created programs to promote small-scale and *campesino* irrigation, but a number of projects have been denied subsidies because of inability to get legal title to unused waters (Maffei and Molina, 1992). Finally, peasant farmers' lack of political and economic clout is a more acute problem in today's context of minimal state regulation, in which private parties must rely more heavily on their own bargaining power to

resolve conflicts or coordinate interests. In short, the Code's distributional impact has probably been negative; at best poor farmers have been marginalized. [Rosegrant and Gazmuri (1994) and World Bank (1994) reach the opposite conclusion, claiming that the Water Code has made small farmers much better off, but provide no supporting evidence.]

8. REFORMING THE WATER CODE

The Center-Left government of the *Concertación*, led by President Patricio Aylwin, was elected in 1989 and assumed power from the military in 1990. (The leftist members of the coalition are more like social democrats than radical socialists, having come around to the advantages of the market economy; in Chile this is called "renovated socialism.") Its primary goals were to consolidate democracy, increase spending on social programs, and maintain rapid, market-driven, and export-oriented economic growth. Among its lesser goals was to reform the 1981 Water Code, which was considered to have gone too far in its privatizing zeal. The DGA was assigned to consult with other state agencies and with private and nongovernmental interests, and prepare a new "National Water Policy." This would include whatever proposals for legislative changes were needed to address the more pressing problems identified. The government sent the proposals to Congress in December 1992 (Bauer, 1995; Dirección General de Aguas, 1991, 1993a; Manríquez, 1992).

The government's main criticism of the Code has been that it is too permissive with a public resource, allowing speculation and lack of use. The DGA argued that this was socially unjust as well as economically undesirable — letting private parties profit from public resources without fulfilling a useful social function in return, and holding back economic development by discouraging productive activities. A large majority of the people I interviewed agreed, including many conservatives; only convinced neoliberals accepted the view that speculation makes markets work better by helping identify social demands for resources. The DGA proposed going back to the earlier rule that acquiring or owning water rights required actually using them. Any rights not used for a period of five years could be cancelled without compensation (whether by administrative or court order was yet to be determined), and then reallocated to other users with more immediate needs. The DGA's legal argument was that since water itself is still publicly owned, the state can impose some conditions on private rights to use it without violating the property status of those use-rights. The government also proposed additional reforms to tighten regulations, including creating

new river basin organizations to coordinate multiple water uses.

The proposed five-year rule met strong opposition from the Right and from private sector interest groups, especially farmers. Many of these critics shared the government's concern about speculation and non-use but said the proposal was the wrong solution. They rejected it as unconstitutional, arguing that the state could not place new restrictions on vested property rights without paying compensation. (That was clearly the intent of the military government, and the Chilean Supreme Court and Constitutional Tribunal would almost certainly agree.) More broadly they attacked the package of reforms as a typically "statist" approach, reminiscent of the dark days of the Agrarian Reform and showing how shallow was the *Concertación's* proclaimed commitment to the neoliberal economic model. The proposals increased "administrative discretion" (i.e., abuse of bureaucratic power) and undermined the model's key elements: security of private property, economic liberty, and the neutrality of the free market. Some of the government's opponents argued that the water market had worked well; many agreed that if the Code had flaws they should be corrected in a way compatible with its market logic, such as a financial incentive of some sort. Some simply opposed any added state authority, e.g., rejecting a proposal that the DGA be able to require minimum ecological flows as a condition for granting new water rights in the future.²⁵

By late 1993 the opposition had forced the government to withdraw its proposals and regroup. The *Concertación* was reelected in December under President Eduardo Frei Ruíz-Tagle. Although the five-year rule was dead in the water, the government rescued the notion of an economic instrument, which the opposition had accepted at least in principle and which seemed more constitutional. Since then (1994–96) a consensus has been growing in favor of some kind of *patente*, or fee for non-use. It is patterned after the *patente* in Chilean mining law: the owner of a mining concession has the right to develop public property (i.e., minerals), but must make actual use of this right or else pay an annual fee to maintain it. In this way the public interest is served either by encouraging development or by gaining revenue. The government sent its new proposals to Congress in July 1996, somewhat increasing DGA authority and adding an annual fee for all unused water rights. The fees vary by region and increase sharply over time (they also differ for consumptive and nonconsumptive rights). The new reforms have been criticized by many of the government's opponents and their fate is unclear.

The debate in Chile about the water market has gotten somewhat more sophisticated in the last couple of years, as the issue has become more

familiar. The economic stakes have risen as demands increase, and Chilean news media give more frequent coverage to water problems. Government agencies have started to collect information about water rights transactions, as key officials marshal their arguments about the imperfections of the current market and hence the need to modify the legal framework. Local university researchers have begun to do studies and consultants to write reports. What outsiders to Chile often do not realize is how politicized this debate remains. The Water Code is such a faithful and symbolic reflection of the larger neoliberal model that most discussion of water rights and water markets is strongly colored by deeper disagreements about the Agrarian Reform, the military government, its economic policies, and so forth. People's claims about the performance of the water market are closely related to their overall political views. Raising the ideological stakes, of course, tends to simplify the arguments and prevent more empirical evaluation.

9. LESSONS AND CONCLUSIONS

Chile's recent experience with water rights illustrates both strengths and weaknesses of market-oriented water policies. The 15 years since the 1981 Water Code offer a unique opportunity to study the results of such policies, which is why other countries and international development organizations are interested in the Chilean model. This article has focused on private sales and purchases of water rights, nearly always involving agriculture, which as the simplest arena for market transactions we would expect to be the most active. Nonetheless, the empirical results have been quite mixed, suggesting that the Chilean model is something for other countries to learn from rather than to copy.

Several of the Water Code's provisions have almost certainly been beneficial. Water users strongly support the increased legal security of private property rights, which in a few areas has encouraged investment in agricultural water use, especially those growing high-value export crops like fruit. Stronger property rights have also helped to consolidate the autonomy of local canal associations, which vary greatly in organizational capabilities but in many places do a reasonable job of day-to-day water management. Furthermore, the Code's flexibility is an advantage even if transactions are uncommon, simply by making it potentially easier to change allocation or use of resources. It has somewhat increased the flexibility of the land market, though the importance of this has been exaggerated (Valdes, 1993).

On the other hand, the Code's most directly market-oriented mechanisms and incentives have so far been less effective. Despite some dissenting

opinions, most evidence confirms that in central and southern Chile — the nation's agricultural heartland — water rights transactions separate from land have been routine but infrequent, involving relatively little reallocation of resources. Water markets, in other words, have been fairly inactive, due to transactions costs and other obstacles, and even in the desert North they are the exception rather than the rule (which is why the Limarí River basin is mentioned so often, e.g., Confederación de Canalistas de Chile, 1993; Hearne, 1995). The infrequency of auctions shows other constraints on market mechanisms. On the whole these results are quite similar to water markets in the Western United States, whose limitations have been amply documented.

The results are open to interpretation. It may be that water resources were already allocated rather efficiently by the early 1980s, both within agriculture and across other sectors, thanks to the end of land reform; in that case, few transfers would be needed. This seems dubious in light of the country's dynamic economic transformation over the past 20 years, particularly since water rights titles in the Reform sector were not determined until the late 1980s (years after the expropriated land had been subdivided and privatized). The market might be effective even with few transactions, if it set a price that accurately signalled water's value. Howe *et al.* (1986) argue that even a small margin of transferable water can significantly increase efficiency. One can also argue that the very lack of sales in Chile shows that market logic has worked, since evidently water is not yet scarce enough to drive up the price.

But we have seen that price signals are confusing or contradictory. This joins with high transactions costs to undermine what are often theoretically claimed to be the Code's main advantage: market incentives to conserve water. Despite hopes for private investment in more efficient water use in order to sell the resulting surplus, the government has had to subsidize it since 1985. Part of the incentives' weakness is due to the military government's original decision to privatize water rights without financial costs or legal obligations to use. We might expect the market to become more active in the future as continuing economic growth increases conflicting demands for water, and indeed

this may already be happening in some areas near Santiago and in the arid North.

These results have several larger implications. First, they emphasize how much market mechanisms in water and other natural resources depend on their wider contexts and preconditions. How they work is influenced by legal rules, political choices, institutional arrangements, economic and geographic conditions, and cultural practices — they are, in short, unavoidably complicated. For the same reasons they can never be "neutral," automatic, or self-regulating, as some of their proponents claim. This is especially notable in a case like Chile where political conditions for pure neoliberal policies were as favorable as we are ever likely to find. One obvious lesson is that we should not oversimplify what is involved in designing and implementing pro-market policies.

In particular, such mechanisms perform unevenly one of their most basic functions: determining prices. Without price signals markets cannot transmit information about supply and demand. But measuring the different values associated with water uses turns out to be quite hard in practice, and in any case does not result from *laissez-faire* operation (Saliba and Bush, 1987). I am not arguing that we should disregard market prices, but simply that we should have limited faith in their accuracy or in what they represent.

Finally, recall that these mixed results apply to the aspect of water market mechanisms that we would expect to be most effective: private exchange of irrigation rights. The limitations of these mechanisms are more serious when it comes to more complicated problems, such as multiple water uses, environmental protection, and conflict resolution. In Chile diverse pressures on water resources have been growing for decades and worsening in recent years. These problems are both theoretically and practically too difficult for free market solutions: they can rarely be solved by a simple exchange of rights, and when private bargaining breaks down the conflicts highlight the importance of wider legal and political institutions. [I discuss these issues in a future article on the role of the courts in river basin conflicts, particularly between irrigation and hydroelectricity (Bauer, forthcoming).] Water markets, in short, should be approached with care and modest expectations.

NOTES

1. These arguments reflect the overall perspective of the field of law-and-economics (also known as the "property rights school"), dominated by the University of Chicago; see Coase (1988); Cooter and Ulen (1988); Posner (1986). On water rights in particular, see Anderson (1983); Rosegrant and Binswanger (1994); Rosegrant and Gazmuri (1994); Smith (1988); World Bank (1993).

2. This overall perspective reflects the rival tradition of institutional economics — see Bardhan (1989); Bromley (1982, 1991); Hodgson (1988); Polanyi (1944) — as well as the fields of history, law, and other social sciences. On the strengths and weaknesses of water markets in particular, see Brajer *et al.* (1989); Colby (1990); Frederick (1986); Livingston (1993); Saliba and

Bush (1987); Willey (1992); World Bank (1993); Young (1986).

3. On the political and economic evolution of the military government, see Büchi (1993); Cavallo *et al.* (1989); Constable and Valenzuela (1991); Drake and Jaksic (1991); Vergara (1985).

4. The Code was dictated as Decree with Force of Law 1,122, published in the *Diario Oficial* on Oct. 29, 1981. (In Chile a D.F.L. is issued by the Executive but has the force of legislation.) Overviews of the Code can be found in Bauer (1993, 1995); Figueroa (1992); Manríquez (1992); Muñoz (1986); Navarrete (1989); Ríos and Quiroz (1995); Rosegrant and Gazmuri (1994).

The Code declares waters to be “national property of public use” (*bienes nacionales de uso público*), a legal category which by definition cannot be alienated from public ownership nor enter into private commercial relations. Other examples of this category include roads, streets, plazas, bridges, and beaches. Ownership (*dominio*) in Chilean civil law includes the rights to arbitrarily use, enjoy, and dispose of (alienate) the thing owned, as long as others’ rights are not affected. (See Articles 582–583 of the Civil Code.) Thus an individual can own a water right but not the water itself, since it is only the former that he is free to sell. The distinction seems artificial, and indeed many Chilean water lawyers — even if personally pro-market — consider the Code to be juridically incoherent, effectively privatizing a resource which it simultaneously defines as inalienably public (Borquez, 1986; Ellenberg, 1980; Soriano, 1986; Vergara, 1990, 1991a). Others defend the Code’s definition as the only way to harmonize market logic with the essential “peculiarity” of the resource (Escudero, 1990; Figueroa, 1992; Instituto Libertad y Desarrollo, 1993). See also section (4) below.

5. Matus (1986); Peralta (1989). Some three-fourths of Chile’s irrigated land is watered by private canals built before 1920, and the rest by state projects built since then.

6. The Code’s only mention of multiple uses is its creation of a new kind of water right, called “nonconsumptive,” intended mainly to encourage hydroelectric development. Nonconsumptive rights require waters to be returned to their original channels after being used, without injuring prior consumptive rights-holders downstream. They have caused and encountered unexpected problems (see Bauer, 1995, forthcoming).

7. For historical background see Bauer (1995); Soriano (1986); Stewart (1967); Vergara (1990, 1991a, b, 1992).

8. See Ellenberg (1980); ICIRA (1968); Jensen (1970); Medina (1970); Parks (1976); Vergara (1990). Although the new Code was part of the 1967 legislation, it was republished as a separate law in 1969, and is referred to as the 1969 Code.

9. The Commission’s sessions on water rights have been republished in *Revista de Derecho de Minas y Aguas*, Vol. 1 (1990, pp. 227–259) (Santiago). Military lawyers’ concerns about the public ownership of water are apparent

in Act N.280, Sept. 3, 1976, *Actas de Sesiones de la Honorable Junta de Gobierno* (unpublished). See Bauer (1995, p. 48).

10. Decree Law 2,603 was published in the *Diario Oficial* on April 23, 1979. Although it repealed and replaced fundamental elements of the 1969 Code, it left the bulk of it intact until an entirely new one could be promulgated. For legal commentary see Dougnac (1989); Ellenberg (1980); Escudero (1990); for the economic arguments in favor, Büchi (1993); Centro de Estudios Públicos (1992); Figueroa (1993); Instituto Libertad y Desarrollo (1993); Venezian and Gurovich (1980).

11. Compare the Proyecto de Decreto Ley with the final version, in *Decretos Leyes Dictadas por la Honorable Junta de Gobierno: Transcripción y Antecedentes*, Tomo 167, Folio 1–356, in the Biblioteca del Congreso Nacional.

12. See Act N.364, February 7, 1979, *Actas de Sesiones de la Honorable Junta de Gobierno* (unpublished). General Pinochet declared himself especially concerned about the insecurity of water rights: “This Decree Law is costing me a lot of sleep. This business has been a permanent, life-long bomb in the countryside: people kill each other. Now, my great worry...is that this may serve so that the people who have water can blackmail the poor ones who lack it...until the latter get bored and have to sell their land.”

13. See the interviews with the Minister of Agriculture and the President of the Confederation of Chilean Irrigators, in *El Mercurio*, April 24, 1979, pp. A1, A12, and October 31, 1981, p. C3; also the May 1979 edition of *El Campesino*, the journal of the National Agricultural Society. Although loyal to the military government, these interests protested for years the impact of neoliberal policies on agriculture.

14. The great majority of sales involved small quantities of water, from one to five *regadores* (a *regador* is a unit of measurement which in this area is equal to about 15 liters/second, sufficient to irrigate 8–10 ha). The figures cited do not include over 100 exceptional sales made after 1986. After more than 10 years’ delay, in 1984 the DGA granted the Region’s largest canal association, Canal Laja, new contingent (“junior”) rights to add to its senior rights in the Laja River. The canal then disposed of these rights in small increments to many of its members to rationalize existing water distribution.

15. According to the present head of the DGA, the real significance of the Elqui case is that even those sales that did take place involved paper titles that had been long unused, rather than “wet water” (interview with Humberto Peña, October 1995). See section 6(b) below.

16. Interviews with and unpublished documents by Eugenio Lobo, Gustavo Manríquez, Humberto Peña, and Pablo Anguita, 1991–95.

17. See Rosegrant and Gazmuri (1994); Rosegrant and Binswanger (1994). They provide some data indicating routine water rights transactions, but do not mention other or conflicting research. Although it is a minor point they get

two key dates wrong: the Agrarian Reform Law was enacted in 1967 not 1966, and water rights were made tradable in 1979 not 1976 (e.g., Rosegrant and Gazmuri (1994, p. 60).

See also Instituto Libertad y Desarrollo (1993), a neoliberal center of policy analysis associated with Chile's most rightwing political party, praising the Water Code and criticizing reforms proposed by the Center-Left government, discussed in section (8) below; Valdes (1993), a World Bank economist saying that the water market has been critical to the land market and has "importantly facilitated changes in [agricultural] output and composition" (p. 4, 13); and World Bank (1994), probably the most inaccurate and misleading of all, a description of the Chilean Code aimed at persuading Peru to imitate it. Also see the recent exchange of letters to the Editor of *The Economist* magazine (September 2 and 16, 1995), by M. Thobani (author of World Bank, 1994) and C. Bauer. The World Bank's recent Policy Paper on water resource management (1993) is more balanced, recommending privatization with a strong regulatory framework, though the emphasis is on the former. Another World Bank publication, Ríos and Quiroz (1995) broadly agrees with my analysis here and in Bauer (1993) while drawing more positive conclusions about the market's results.

18. In Los Angeles, the Water Rights Registers that recorded 150 sales in 1980–91 also contained 1,000 instances of local courts approving use of the Transitory Articles to register rights; 900 of them involved the Agrarian Reform. In Los Andes the figures are similar: 575 regularizations in the seven even years during 1980–92, which can probably be extrapolated to a total of more than 1,000, over 80% pertaining to the Reform sector.

19. See the Supreme Court decisions in *Mozo con SENDOS* (March 12, 1985), in *Fallos del Mes* N.316 (pp. 33–38); and *Colegio de Ingenieros con Guzmán* (Nov. 13, 1990), in *Fallos del Mes* N.384 (pp. 662–675). See also Agurto (1988); Dougnac (1989).

20. Interview, Fernando Peralta, President of the Confederation of Chilean Irrigators, Santiago, 1991.

21. Interview with Rafael Del Valle, water lawyer, Santiago, 1992.

22. Michael Hanemann, University of California-Berkeley, personal communication, 1996.

23. This argument was confirmed in many interviews in Los Andes and in the Santiago area, where most people could not recall a single example of a local irrigator selling water rights after investing in more efficient technology. See also "El riego por goteo ha sido mi mejor inversión," *El Campesino* (May 1979, pp. 34–37).

24. I rely here on interviews and field-visits with personnel of the Agriculture Ministry's Institute of Agricultural Development (INDAP), and of the nongovernment organizations AGRARIA, GIA (Grupo de Investigaciones Agrarias), and SEPADE (Servicio Evangélico para el Desarrollo). See also GIA (1986); SEPADE (1989).

25. Confederación de Canalistas de Chile (1993); Donoso (1994); ENDESA (1993); Figueroa (1992, 1993); Instituto Libertad y Desarrollo (1993); Sociedad Nacional de Agricultura (1993).

REFERENCES

- Agurto, P. (1988) Los derechos de aprovechamiento de aguas no inscribibles. *Gaceta Jurídica* 99, 3–11.
- Anderson, T. (Ed.) (1983) *Water Rights: Scarce Resource Allocation, Bureaucracy, and the Environment*. Pacific Institute for Public Policy Research, San Francisco.
- Bardhan, P. (1989) Alternative approaches to the theory of institutions in economic development. In *The Economic Theory of Agrarian Institutions*, ed. Pranab Bardhan, pp. 3–17. Clarendon Press, Oxford.
- Bauer, C. (1993) Los derechos de agua y el mercado: Efectos e implicancias del Código de Aguas Chileno de 1981. *Revista de Derecho de Aguas* 4, 17–63.
- Bauer, C. (1995) Against the current? Privatization, markets, and the state in water rights: Chile, 1979–93. Ph.D. dissertation. University of California, Berkeley, CA.
- Bauer, C. (forthcoming) Slippery property rights: Multiple water uses and the neoliberal model in Chile, 1981–1995. *Natural Resources Journal*.
- Borquez, M. C. (1986) El Derecho de Aprovechamiento de Aguas, Law thesis. University of Concepción, Concepción.
- Brajer, V., et al. (1989) The strengths and weaknesses of water markets as they affect water scarcity and sovereignty interests in the West. *Natural Resources Journal* 29, 489–509.
- Bromley, D. (1982) Land and water problems: An institutional perspective. *American Journal Agricultural Economics* 64, 834–844.
- Bromley, D. (1991) *Environment and Economy: Property Rights and Public Policy*. Basil Blackwell, Inc., Cambridge, MA.
- Brown, F. L. et al. (1982) Water reallocation, market proficiency, and conflicting social values. In *Water and Agriculture in the Western U.S.: Conservation, Reallocation, and Markets*. Studies in Water Policy and Management. No. 2 ed. G. Weatherford, pp. 191–256. Westview Press, Boulder, CO.
- Brown, F. L. and Ingram, H. (1987) *Water and Poverty in the Southwest*. University of Arizona Press, Tucson.
- Büchi, H. (1993) *La Transformación Económica de Chile: Del Estatismo a la Libertad Económica*. Grupo Editorial Norma, Bogotá, Columbia.
- Cavallo, A. et al. (1989) *La Historia Oculta del Régimen Militar*. Editorial Antártica, Santiago.
- Centro de Estudios Públicos (1992) *El Ladrillo: Bases de la Política Económica del Gobierno Militar Chileno*. Centro de Estudios Públicos, Santiago.

- CEPAL (1960) *Los Recursos Hidráulicos de América Latina: Chile*. United Nations, Mexico City.
- Coase, R. (1988) *The Firm, the Market, and the Law*. University of Chicago Press, Chicago.
- Colby, B. (1990) Transactions costs and efficiency in Western water allocation. *American Journal of Agricultural Economics* 72, 1184–1192.
- Confederación de Canalistas de Chile (1986) *1ª Convención Nacional de Regantes de Chile*. Confederación de Canalistas de Chile, Santiago.
- Confederación de Canalistas de Chile (1989) *2ª Convención Nacional de Regantes de Chile*. Confederación de Canalistas de Chile, Santiago.
- Confederación de Canalistas de Chile (1993) *3ª Convención Nacional de Regantes de Chile*. Confederación de Canalistas de Chile, Santiago.
- Constable, P. and Valenzuela, A. (1991) *A Nation of Enemies: Chile under Pinochet*. W. W. Norton and Co., New York
- Cooter, R. and Ulen, T. (1988) *Law and Economics*. Harper, Collins, St. Louis.
- Dirección General de Aguas (1991) Bases para la formulación de la Política Nacional de Aguas. *Revista de Derecho de Minas y Aguas*, 2, 259–65.
- Dirección General de Aguas (1993a) Actas del Seminario sobre Política Nacional de Aguas. *Revista de Derecho de Aguas*, 4, 159–204.
- Dirección General de Aguas (1993b) Catastro general de usuarios de aguas de la primera sección del Río Aconcagua. Photocopy, Santiago.
- Donoso, G. (1994) Proyecto de reforma del Código de Aguas: ¿Mejora la asignación del recurso? *Panorama Económico de la Agricultura* 92, 4–11.
- Dougnac, F. (1989) La ‘ley’ como modo de adquirir el dominio de los derechos de aprovechamiento de las aguas. In Confederación de Canalistas de Chile. *2ª Convención Nacional de Regantes de Chile*, pp. 179–184. Confederación de Canalistas de Chile, Santiago.
- Drake, P. and Jaksic, I. (1991) (Eds.) *The Struggle for Democracy in Chile, 1982–90*. University of Nebraska Press, Lincoln.
- Echenique, J. and Rolando, N. (1989) *La Pequeña Agricultura: Una Reserva de Potencialidades y una Deuda Social*. AGRARIA, Santiago.
- Ellenberg, J. (1980) Antecedentes Respecto del Nuevo Régimen Legal de Aguas. Law thesis. University of Chile, Santiago.
- ENDESA (1993) El derecho de aprovechamiento de agua en Chile: Visión de ENDESA. Photocopy, Santiago.
- Escudero, B. (1990) *La Posesión del Derecho de Aprovechamiento de Aguas*. Ediar Conosur Ltda., Santiago.
- Figueroa, L. S. (1992) Estatuto jurídico de las aguas: Evolución histórica y cultural. *Derecho en la Región* 1, 25–36.
- Figueroa, L. S. (1993) Cambios a la legislación de aguas. *El Mercurio*, p. A2.
- Frederick, K. (Ed.) (1986) *Scarce Water and Institutional Change*. Resources for the Future. Washington D.C.
- Garrido, J. et al. (1990) *Historia de la Reforma Agraria en Chile*. Editorial Universitaria, Santiago.
- GIA (1986) El riego: Un problema campesino, *Noticiero de la Realidad Agraria*. No. 17. Grupo de Investigaciones Agrarias, Santiago.
- Gómez, S. and Echenique, J. (1988) *La Agricultura Chilena: Las Dos Caras de la Modernización*. FLACSO/AGRARIA, Santiago.
- Hearne, R. (1995). The market allocation of natural resources: Transactions of water use rights in Chile. Ph.D. dissertation. University of Minnesota, Minneapolis.
- Hodgson, G. (1988) *Economics and Institutions: A Manifesto for a Modern Institutional Economics*. University of Pennsylvania Press, Philadelphia.
- Howe, C., et al. (1986) Innovative approaches to water allocation: The potential for water markets *Water Resources Research* 22, 439–445.
- ICIRA (1968) *Exposición Metódica y Coordinada de la Ley de Reforma Agraria de Chile*. Instituto de Capacitación e Investigación en Reforma Agraria, Santiago.
- Instituto Libertad y Desarrollo (1993) Análisis y comentario de la propuesta reforma del Código de Aguas. Photocopy, Santiago.
- Jarvis, L. (1985) *Chilean Agriculture under Military Rule: From Reform to Reaction, 1973–80*. University of California Institute for International Studies, Berkeley.
- Jarvis, L. (1988) The unraveling of Chile’s Agrarian Reform, 1973–86. In *Searching for Agrarian Reform in Latin America*, ed. W. Thiesenhausen, pp. 240–275. Unwin Hyman, Winchester, MA.
- Jensen, D. (1970) Chile’s new Water Code and agrarian reform: A case study. Report No. 41. University of Wisconsin Land Tenure Center, Madison.
- Korovkin, T. (1992) Peasants, grapes, and corporations: The growth of contract farming in a Chilean community. *Journal of Peasant Studies* 19, 228–254.
- Livingston, M. (1993) Designing water institutions: Market failures and institutional response. World Bank Policy Research Working Paper, No. 1227. World Bank, Washington D.C.
- Maass, A. and Anderson, R. (1978) *And the Desert Shall Rejoice: Conflict, Growth, and Justice in Arid Environments*. MIT Press, Cambridge, MA.
- Maffei, E. and Molina, J. (1992) Evaluación del Programa de Riego Campesino (Convenio FOSIS/INDAP). Photocopy FOSIS, Santiago.
- Manríquez, G. (1992) Política nacional de aguas: Formulación, objetivos, instrumentos, opciones, alternativas, y proposiciones. *Derecho en la Región* 1, 65–80.
- Matus, R. (1986) Antecedentes históricos del riego en Chile: Situación actual y perspectivas futuras. In Confederación de Canalistas de Chile, *1ª Convención Nacional de Regantes de Chile*, pp. 70–81. Confederación de Canalistas de Chile, Santiago.
- Medina, R. (1970) Some aspects of legal control over water use for agriculture in central Chile: A case study. Ph.D. dissertation. University of Wisconsin, Madison.
- Muñoz, G. (1986) Legislación de aguas. In Confederación de Canalistas de Chile, *1ª Convención Nacional de Regantes de Chile*, pp. 25–31. Confederación de Canalistas de Chile, Santiago.
- Navarrete, P. (1989) Rol subsidiario del Estado en el actual Código de Aguas y su implementación. In SEPADE, *Riego: Distintas Visiones sobre la Aplicación del Código de Aguas*, pp. 7–11. Servicio Evangélico para el Desarrollo, Concepción.
- Parks, L. L. (1976) Estimation of water production functions and farm demand for irrigation water with

- analysis of alternatives for increasing the economic returns to water on Chilean farms. Ph.D. dissertation. University of California, Davis.
- Peralta, F. (1989) *Ideas para la Discusión de una Política de Riego: Su Aplicación en el Caso de Chile*. Ediciones Tacora Ltda., Santiago.
- Peralta, F. (1995) El mercado del agua en Chile, Paper presented at Workshop on Issues in Privatization of Water Utilities in the Americas, October 4–6. American Society of Civil Engineers/CEPAL, Santiago.
- Polanyi, K. (1944) *The Great Transformation*. Farrar and Rinehart, Inc., New York.
- Posner, R. (1986) *Economic Analysis of Law*. Little, Brown, Boston.
- Ríos, M. and Quiroz, J. (1995) The market of water rights in Chile: Major issues. World Bank Technical Paper, No. 285. World Bank, Washington, D.C.
- Rodríguez, D. and Venegas, S. (1989) *De Praderas a Parronales: Un Estudio Sobre Estructura Agraria y Mercado Laboral en el Valle de Aconcagua*. Grupo de Estudios Agro-Regionales, Santiago.
- Rosegrant, M. and Binswanger, H. (1994) Markets in tradable water rights: Potential for efficiency gains in developing country water resource allocation. *World Development* **22**, 1613–1625.
- Rosegrant, M. and Gazmuri, R. (1994) Tradable water rights: Experiences in reforming water allocation policy. Photocopy Irrigation Support Project for Asia and the Near East. Washington DC: U.S.A.I.D.
- Saliba, B. C. and Bush, D. (1987) *Water Markets in Theory and Practice: Market Transfers, Water Values, and Public Policy*. Studies in Water Policy and Management No. 12. Westview Press, Boulder, CO.
- SEPADE (1989) *Riego: Distintas Visiones sobre la Aplicación del Código de Aguas*. Servicio Evangélico para el Desarrollo, Concepción.
- Smith, R. (1988) *Trading Water*. Council of State Policy and Planning Agencies, Washington, D.C.
- Sociedad Nacional de Agricultura (1993) Código de aguas: Observaciones de la SNA al proyecto que modifica la ley. *El Campesino*, pp. 8–14.
- Soriano, L. C. (1986) *Las Aguas en nuestro derecho*. Law thesis. University of Concepción, Concepción.
- Stewart, D. (1967) Aspects of Chilean water law in action: A case study. Ph.D. dissertation. University of Wisconsin, Madison.
- Valdes, A. (1993) Mix and sequencing of economywide and agricultural reforms: Lessons of experiences of reforms in Chile after 1974. Paper presented at Eastern Economic Association Conference, March 19–21, Washington, D.C.
- Venezian, E. and Gurovich, L. (1980) Uso eficiente del agua de riego en Chile a través de una moderna política de aguas. *Ciencia e Investigación Agraria* **7**(2), 115–125.
- Vergara, A. (1990) Contribución a la historia del derecho de aguas, I: Fuentes y principios del derecho de aguas chileno contemporáneo (1818–1981). *Revista de Derecho de Minas y Aguas* **1**, 111–145.
- Vergara, A. (1991) Hipótesis para una reconstrucción histórica y dogmática del derecho de aguas. *Revista de Derecho Público* **49**, 217–226.
- Vergara, A. (1991) La codificación del derecho de aguas en Chile (1875–1951). *Revista de Estudios Histórico-Jurídicos* **14**, 159–213.
- Vergara, A. (1992) Contribución a la historia del derecho de aguas, III: Fuentes y principios del derecho de aguas indiano. *Revista Chilena de Derecho* **19**, 311–332.
- Vergara, P. (1985) *Auge y Caída del Neoliberalismo en Chile*. FLACSO, Santiago.
- Willey, Z. (1992) Behind schedule and over budget: The case of markets, water, and the environment. *Harvard Journal of Law and Public Policy* **15**, 391–425.
- World Bank (1993) *Water Resources Management: A World Bank Policy Paper*. World Bank, Washington D.C.
- World Bank (1994) Peru: A user-based approach to water management and irrigation development. Report No. 13642-PE. World Bank, Washington, D.C.
- Young, R. (1986) Why are there so few transactions among water users? *American Journal Agricultural Economics* **68**, 1143–1151.