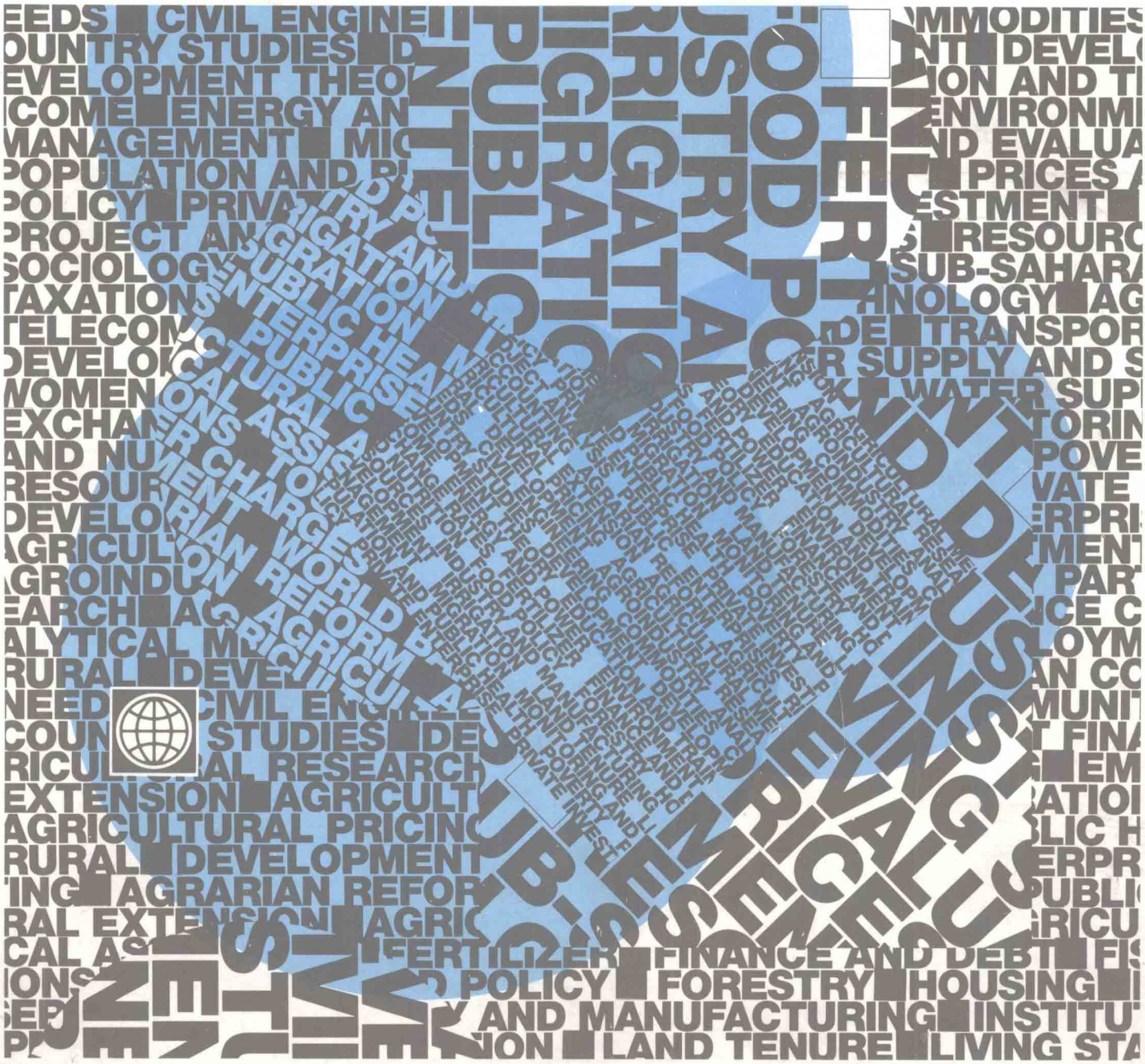
WORLD BANK TECHNICAL PAPER NUMBER 315

Water Allocation and Water Markets

An Analysis of Gains-from-Trade in Chile

Robert R. Hearne and K. William Easter



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FOREWORD

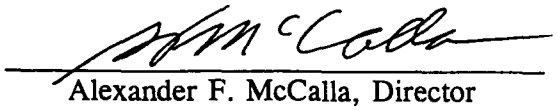
With the publication of its 1993 policy paper *Water Resources Management*, the World Bank made a commitment to assist developing countries in establishing institutional frameworks and management procedures that would enable countries to utilize their water resources in an economically and environmentally sustainable manner. The impetus for the policy came from the alarming deterioration and increasing scarcity of freshwater resources around the globe, caused mainly by growing population pressures and the failure to properly consider the economic value of water. Usually when water is given little or no economic value, it is misallocated and misused.

This paper is intended to reinforce the World Bank's overall effort to improve the management of natural resources and to highlight the importance of water resources in particular. The Bank's 1993 *Water Policy Paper* and the 1994 technical paper, *A Guide to the Formulation of a Water Resources Strategy*, were the first steps in this process.

The paper focuses on water allocation problems and the performance of water markets in improving allocation. By examining specific case studies in Chile, one of the few countries that has encouraged markets for water, it demonstrates that water can no longer be treated as a free good and better ways must be found to improve its allocation and use. Efficient water markets are one means of improving water allocation, while at the same time providing a mechanism to directly compensate existing water users. In addition, as the market value of water becomes clear to water users, they will use it more efficiently.

The findings in the paper suggest that market transfers of water use rights in the study area produce economic gains both in intersectoral trades and in trades among farmers, and that they produce rents for both buyers and sellers. The extent of trade and the level of gains vary depending on river basin locations, the alternative value of water in present use, water delivery infrastructure and the cost of the transactions.

Our hope is that this paper will encourage professionals engaged in water resources management to adopt practices that produce the desired outputs, but do not have unwanted impacts on the environment. It is important that we give users incentives to make better use of water resources. Without such incentives, the misallocation of water resources will continue and future generations will find their opportunities for water use severely restricted.



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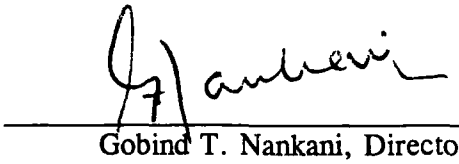

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EXECUTIVE SUMMARY

With the growing concern about the increased scarcity and inefficient allocation and use of water resources, attention has been focused on the use of markets to allocate water. Market-based allocation could secure water supplies for high-value uses in urban and rural areas without the need to develop costly new sources of supply that may be environmentally damaging. Also, by requiring compensation for water transferred away from low valued uses, water markets provide an incentive for more efficient water use in agriculture, industry, and municipalities. Furthermore, if markets work efficiently, price signals can provide the information needed to allocate water more effectively than models developed by a central water resources management agency.

Chile is one of the few countries that has encouraged the use of markets in water resource management. The market allocation of water in Chile is possible, in part, because a system of transferable water-use rights was reestablished in 1981. These rights are independent of land use and land ownership. Thus, trades of water rights are not tied to land sales. When combined with flexible irrigation infrastructure such as adjustable gates and effective water user associations (WUAs), these rights can stimulate a relatively active water market in areas of water scarcity.

Given the hope that the market allocation of water-use rights can offer a possible solution to the problems of increased scarcity and inefficient allocation of water resources, this study of water markets in Chile was initiated in late 1993. In order to assess the impact of water markets and transactions costs in Chile, four river valleys, the upper Maipo, the Elqui, the Limarí, and the Azapa were selected as case studies. The sale of water-use rights in the Elqui and Limarí valleys, during the years 1986 to 1993, was analyzed to determine the gains-from-trade from market transfers. In the upper Maipo valley, transactions were rare and were not included in the analysis. Similarly, in the Azapa valley, only a few transactions were identified, and gains-from-trade were not calculated. In the Elqui valley, transactions were infrequent and constrained by the lack of adjustable gates, but there were significant intersectoral transfers as well as a slow transfer of water-use rights within agriculture. In the Limarí valley, with its well-developed system of irrigation infrastructure and well organized WUAs, transactions were relatively frequent.

In the analysis of water markets, crop budgets were used to estimate the value of water in agricultural production. The value of water-use rights to urban water supply companies was estimated using the avoided cost of the next best alternative investment. The analysis demonstrated that the market transfer of permanent water-use rights produced substantial economic gains-from-trade in both the Elqui and Limarí valleys. These economic gains were present in intersectoral trades and in trades between farmers, and they produced gains for both buyers and sellers.

Buyers, especially farmers growing profitable crops who bought water-use rights and individuals buying rights for potable water supply, received higher rents than sellers. Large table grape producers in the Limarí valley and individuals buying water for human consumption in the Elqui valley received the highest rents. In the Elqui valley, total and net gains-from-trade per share (average of 0.5 liters/second) were within the range of recent transfer prices of US $1,000. In the Limarí valley, gains-from-trade of water-use rights were three times the recent

transaction prices of US$3,000 for a share (4,250 m^3 annually) of water from the Cogotí Reservoir.

In the Elqui valley, where intersectoral trading occurred, most of the water-use rights transferred out of agriculture were not used by their owners prior to the sale. This means that there are considerable financial gains from these transactions, while the estimated economic gains to society are relatively modest as someone else is assumed to use the water. It is important to emphasize that in this valley, the intersectoral transfer of water involved sales by individuals who were not actively using the water in farming, rather than sales by active farmers selling marginal quantities of water.

These case studies demonstrate the diversity of water allocation systems and water management practices in northern and central Chile. In areas where trading was active, especially in the Limarí valley, transactions costs have not presented an appreciable barrier to trading. Nonetheless, in the large canal systems with fixed flow dividers, such as those found in the Elqui and Maipo valleys, there have been very few transactions. Various factors facilitate trading, but the absence of trading in these large canal systems highlights the costs of modifying fixed infrastructure, especially for trades between farmers.

Water user associations play an important role in facilitating the market reallocation of water, especially in the Limarí valley where trading is active and in the Elqui valley where intersectoral trading occurs. In the Limarí valley, where reservoir storage, adjustable gates with flow meters, and well organized WUAs helped lower transactions costs, the water market is active and gains-from-trade are substantial.

This study has several important implications for other countries faced with water scarcity:

- First, there are significant gains-from-trade that can be realized by fostering water markets. These gains occur in both intersectoral trades and trades between farmers.

- Second, transferable water-use rights are essential for efficient water markets. These rights can be stipulated by volume or by percentage of river or canal flow. But in areas where water supplies are highly variable, it is necessary to agree on how the rights will be altered during times of scarcity.

- Third, great care should be exercised in the initial allocation of water-use rights among users in order to make sure that all the rights are not captured by a few individuals. If the water is to be used for irrigation and an equitable distribution of land and water already exists, a good strategy is to distribute water-use rights to the owners of land on which the water is being used.

- Fourth, technology such as adjustable gates and institutional arrangements that encourage the formation of active water user's associations can substantially reduce transactions costs and facilitate market trading.

- Fifth, the presence of privately held water rights does not necessarily make it more difficult to reach environmental quality objectives for rivers. Water quality regulations need to be established and enforced irrespective of the water allocation system. In Chile, where river valleys are relatively short, the quantity and quality of return flows may be less problematic than in other countries.

- Finally, within a decentralized system of water resource management, there is a continuing role for water management authorities in enforcing rights and resolving conflicts. Yet if institutional arrangements are established that allow water users to resolve conflicts among themselves, they can avoid the need for further government intervention.

Further considerations should be given to:

- Land use patterns
- Urban water use patterns
- Irrigated vs. dry land agriculture
- Water conveyance technologies as constraint on water market transactions
- Irrigation technologies and their role in a water market setup
- Supporting legal and institutional mechanisms to regulate water market activities
- Role of incentive systems for water savings to enhance water market transactions
- Environmental consequences - negative externalities from water transfer (water quality, soil erosion)
- Third party effects - regional employment and welfare

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I. INTRODUCTION

With the growing concern about the increased scarcity and inefficient allocation and use of water resources, much attention has been focused on the use of markets in water allocation. This market based allocation could secure water supplies for high-value uses in urban and rural areas without the need to develop costly, new sources of supply that may be environmentally damaging. Also by securing compensation for water transferred away from low valued uses, water markets provide an incentive for more efficient water use in agricultural, industrial, and municipal uses. Furthermore, if markets work properly, price signals can provide the information needed for efficient water allocation more effectively than models developed by a central water resources management agency.

The effectiveness of water markets is constrained by the ability of buyers and sellers to measure and transport water, to legalize and enforce transactions, to account for water quality, and to protect the rights of other water users. Thus, the effect of transaction costs and the infrastructure and institutions that reduce these transaction costs are critical to the effectiveness of water markets. In addition, the unconstrained movement of water via private exchanges can produce negative external effects on third party users. There is also the fear that the free exchange of water may disadvantage poor people.

Chile is one of the few countries that has encouraged the use of markets in water resource management. Market allocation in Chile is possible, in part, because a system of transferable water-use rights was reestablished in 1981. These rights are independent of land use and land ownership, thus trade of water rights is fairly unrestricted. The codification of these water-use rights coincided with a series of reforms in the Chilean economy including privatized land rights and liberalized trade.

Although Chile is unique in its water rights system, the challenges that face its system of water resource management are very similar to those that face other countries. The increased population and income in Chile's urban areas is creating an increase in the urban demand for water. In addition, industrial and residential pollution are overburdening the assimilative capacity of many of Chile's rivers.

This paper presents a description and an analysis of water allocation and water markets in Chile. The first part of the paper provides a brief introduction and theoretical framework. The second part of the paper reviews relevant literature. The third section offers background information on water allocation institutions in Chile. The fourth part of the paper presents a brief description of local water markets as well as an analysis of gains-from-trade. The last section provides conclusions as well as general observations on water policy in Chile. Annexed to this paper is a more thorough description of four river basins used as case studies in this analysis. A second annex presents maps of the valleys discussed. A third annex presents crop budgets used in valuing water for the gains-from-trade analysis. A final annex displays the questionnaire used in the survey of farmers who have participated in market exchanges.

Markets for Water and Water-Use Rights

As an introduction to a discussion of water markets it is useful to distinguish between the exchange of water and the exchange of water-use rights. This is appropriate because the distinction highlights the importance of the institutional environment for water resource allocation. The former — sometimes referred to as a "spot market" — occurs when the owner of a legal or prescriptive right to a certain volume or flow of water sells a portion of that water, sometimes outside of legal sanction, to a neighbor in a simple transaction. These exchanges are for a finite period of time — sometimes only a few hours of irrigation. Although the unit of sales may not be metered volumetrically, both buyer and seller have good information on the volume involved. A more permanent transaction involves the exchange of the water-use right itself. This generally requires legal sanction to maintain the security of the right after the transfer. These transfers are generally permanent, but can be for a finite, but extended period of time — at least one irrigation season. And the burden of uncertain supply will fall on the purchaser of the right.

Water Markets, Transaction Costs, and Institutions

Where water is scarce and legally defined transferable property rights exist, market trades can be expected when the difference in the value of water between two uses is greater than the costs of transferring the water. In the absence of transaction costs economic incentives would induce water users to trade water-use rights until the marginal value of these rights was equal across all users. Of course, transaction costs do limit the movement of water and the transfer of water-use rights. Transaction costs for water market transfers include: i) the cost of the physical infrastructure needed to measure and transport water, including the evaporation and filtration losses during conveyance; ii) the cost of searching and finding willing buyers and sellers, and negotiating a contract; and iii) the cost of validating legal ownership of the water-use right, legalizing the contract, enforcing contract provisions, and acquiring necessary permission from regulatory authorities to transfer water. Because these transaction costs can be large, the number of potential buyers and sellers may be limited — which may result in non-competitive pricing.

In order to reduce the burden of these transaction costs, public organizations can be established to construct water delivery infrastructure, to modify and monitor the distribution of river and canal water, to expedite the dissemination of market information, to maintain public records of water-use rights, and to protect the rights of third parties affected by a transfer of water. These services may be provided by a central government, local governments, or community organizations. Many governments have made large investments in irrigation infrastructure and water management authorities. Although these irrigation systems were not generally designed to facilitate market transfers, the presence of flexible infrastructure should reduce the transactions costs of market exchanges. Also, user groups, especially the water user associations (WUAs) that manage and maintain canals, can play important roles in facilitating and monitoring trades.

Because water use is characterized by a high degree of interdependence, individuals may want to restrict the amount and types of transfers that occur. Changes in the allocation of upstream water and irrigation practices can impose a negative externality on downstream users. The transfer of water away from a canal can increase the percentage of water lost in conduction

and evaporation in that canal. An increase in the number of water-use rights flowing through a canal can reduce the amount of water received per water-use right in the canal during times when river levels are high. This is because during high water unlimited withdrawals from the river are permitted, and the only constraint on water delivery is the carrying capacity of the canal. Also, changes in water use can significantly effect water quality. Thus both government authorities and WUAs may want to regulate water transactions to ensure that they are beneficial to the community of water users and society.

II. LITERATURE REVIEW

The market exchange of water and water-use rights is a relatively rare phenomenon, and thus the economic analyses of actual exchanges are scarce. Still, there exists a wide range of literature which addresses issues pertinent to water markets. Unfortunately, much of the relevant literature discusses the water markets of the western U.S.A., but more recently studies have been completed for other areas. There is also a lack of economic research on proper regulatory strategies, methods of reducing transaction costs, and the effectiveness of water markets outside the U.S.A..

Included in the literature is a large number of articles which take an interdisciplinary approach to study the institutions that provide the environment for market allocation. In general these articles review how the prior appropriation doctrine in the western U.S.A. has been modified to provide a well regulated framework for market transfers (Clyde, 1989; Anderson and Leal, 1989; Griffin and Boadu, 1992; Harper and Griffin, 1988; and Schupe et al., 1989). In a 1990 volume pertinent to Chile, Lee traces the development of water distribution systems in Latin America and suggests that water management has been dominated by single purpose government agencies concentrating on the development of large supply projects. He then features four South American case studies, including Chile's Limarí River valley, to describe the organizational difficulties of large multipurpose water systems. In comparison, the case study from Chile is fairly favorable, although the discussion focuses more on the physical characteristics of the system and gives little attention to the institutional concerns in Chile or to market trading.

Along with the literature that explains water institutions, there exists some, mostly non-empirical, economic discussions of water markets and their policy implications. This literature provides a good background of the issues involved with water markets in the western U.S.A. These issues include: transaction costs, hydrological uncertainty, the non-pecuniary value of water, and the "community" value of water (Brajer and Martin, 1989 and 1990); the characteristics of water markets that achieve social welfare (Howe et al., 1986); water quality (Colby Saliba and Bush, 1987; Colby Saliba, 1987); the shadow value of water (Easter and Tsur, 1995); and the rent accruing to water "owners" (Bowen et al, 1991).

A few papers have generalized beyond the experience in the western U.S.A.. Brajer et al. (1989) describes market allocation for the benefit of non-economists, featuring a good discussion of transaction costs and how market imperfection can lead to economic rents. Rosegrant and Binswanger (1992) examine alternative policies to improve water use and environmental management in irrigation and suggest that a market for water-use rights would function well, once water-use rights are established. The authors present a institutional innovation approach to the development of markets — as water prices rise, the institutions requisite for water reallocation will follow.

There are a few empirical studies concerned with the effects of water markets. These studies mainly focus on the benefits of market and administrative transfers of water. In a large study of interregional water transfers within California, Vaux and Howitt (1984) estimate potential annual gains-from-trade for 1980 ($67 million), 1995 ($156 million), and 2020 ($219

million). Chang and Griffin review the water institutions of the lower Rio Grande valley (U.S. side) and estimated the gains-from-trade (ranging from $3,000 to $16,000 per 1000 m^3) for transfers from agriculture to municipal water supply. Dinar and Letey (1991) use a micro-level production model for the central valley of California, and suggest that water markets increase farmers' profits, reduce farmers' use of water — thus reducing the salinity and selenium buildup, and increase farmers' investment in water conserving technologies. Whittelesey and Houston (1984) simulate diversions of water from irrigation to hydrogeneration in the Pacific Northwest and show that the value of water, welfare, and farm income all increase. Hamilton et al. discuss the welfare gains and policy implications of a transfer of provisional water rights from agriculture to a hydroelectric utility in the Pacific Northwest. Maass and Anderson (1978) evaluate the water market in Alicante, Spain, and found that the market system produced greater net increases in regional income than the rotation systems used in neighboring communities.

Another set of articles address water markets and focus on specific policy implications of water trading. Charney and Woodard (1990), and Howe et al. (1990) estimate the effects of rural-to-urban water transfers on the agricultural areas losing water and show that the indirect upstream and downstream effects on rural commercial activity can be significant in highly localized areas. In a simulation of potential California water trades Weinberg et al. (1993) show that although the effect of increased water prices on salinity and selenium accumulation is noteworthy, water markets may not serve as well as a set of well formulated Pigouvian[1] taxes in reducing negative environmental externalities. Colby (1990) investigates the transaction costs required to obtain approval of water transfers and the litigation costs of third party challenges to transfers. She suggests that these institutional constraints can be used as Pigouvian taxes to protect against the negative externalities of water transfers. Colby's estimates of transactions costs average 6% of purchaser's costs for transfers in 4 western states and this is considered not to be a burden. In a fairly detailed analysis, Rosen and Sexton (1993) revisit the transfer of water from the Imperial Irrigation District to the Southern California Metropolitan Water District, and conclude with suggestions of policy reforms that decentralize control over water-use rights.

There is also a limited literature on current water allocation in Chile, although without economic analysis. Two volumes of reports prepared for the National Irrigators Conventions of 1986 and 1989 contain a lot of general information on contemporary water issues as well as many reports on water-use from various river valleys. Gazmuri (1994) provides a good, and very optimistic, review of the primary features of the 1981 Water Code. In a institutional review of the roles of property rights, markets, and the government in water-use in Chile, Bauer suggests that the 1981 Water Code has worked well in the agricultural sector but not so well in intersectoral water allocation. He asserts that private property rights to water have served agriculture well, despite the fact that poor infrastructure, incomplete archives, and a cultural resistance to water sales has limited use of market mechanisms to transfer water. Nonetheless, Bauer (1994) argues that the Water Code has serious flaws in its approach to conflict management, non-consumptive water-use rights, and water quality. Finally, Donoso (1994) reviews the negative economic effects of incentives that could be generated by the proposed use-it-or-loose-it rule on water-use rights.

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[1] A.C. Pigou argued that externalities produce a difference between social and private returns, and a system of taxes and subsidies could be used to internalize these externalities.

III. WATER ALLOCATION INSTITUTIONS IN CHILE

In order for market mechanisms to efficiently allocate water between competing uses, institutions must be in place that enable both buyer and seller to obtain fair value in a trade. The most critical prerequisite for markets is a system of transferable water-use rights. Ideally, these rights should specify the quantity, quality, and timing of water delivery. Water-use rights should also specify the criteria by which water is rationed in times of drought. Also, a system of regulations or taxes may be required to protect third parties from damage and to enforce the privileges and restrictions placed on these rights. Finally, a mechanism of resolving conflicts between water users is necessary.

Water-Use Rights

Chile has a tradition of private development of water resources and private rights to shares of river and canal flows that dates to the colonial era. This tradition is maintained in the National Water Code of 1981[2] which allows private transferable property rights for water use. This water law reversed the 1969 water law, written during a period of land reform, which tied irrigation water to the land and mandated state control over water resources.

The 1981 water law stipulates that water is a national resource for public use but that permanent and transferable rights to utilize water can be granted to individuals in accordance with the law. Water-use rights can be granted by the government upon petition, can be purchased from an individual owner, or can be retained based on traditional use. Currently, there is no stipulation that water-use rights must be utilized in order to be retained.

Rights can be defined as permanent or contingent. Permanent rights are granted for use on unexhausted sources of supply. In most of Chile's river basins, especially in the north and in the central valley, all permanent use rights have already been assigned. Contingent rights are granted for surplus water, that is water flows that exceed those demanded by permanent rights holders during times of high water. Reservoir or lake water is not subject to contingent rights since, under most climatic conditions, the regulation of water flow is sufficient to nullify the chance of excess flows of water.

Rights are also designated as consumptive and non-consumptive. Consumptive rights entitle the user to completely consume the water without any obligation to return it. Non-consumptive rights grant the owner the use of the water as long as it is returned to its source at a specified quality, and does not interfere with consumptive use rights. The law stipulates that rights are to be specified by volume of flow per unit of time. But in reality rights are defined as a share of stream flow, because the high variability of natural river flows prohibits volumetric specification. In order to resolve this inconsistency, natural rivers are divided into sections, and each canal, intake, and withdrawal point receives a percentage of the water in that section of the river. Volumetric equivalencies of river shares are stipulated for the flow of the river that occurs in 85 out of 100 years. When river flows are insufficient to meet volumetric specifications,

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[2] D.F.L. Number 1122, published in the Official Journal, Santiago, October 29, 1981.

water flows into the different intakes are reduced proportionally. However, rights on some rivers have been over allocated so that water flows will be sufficient to meet volumetric specifications in far less than 85% of years.

Since consumptive use rights are granted for the full use of all the water stipulated in the right, downstream users do not have any right to return flows generated from upstream users. Of course, this has little effect on the first section of a river since return flows mostly augment downstream sections. Water users in downstream sections of a river divide water that enters through springs, rainfall, and return flows. These rights holders are not protected by law from any change in upstream water use that significantly reduces return flows. There is also no restriction on the transfer of upstream water to another basin.

Water-use rights are required for groundwater exploitation. Individuals can request from the *Dirección General de Aguas* (General Directorate of Water) a right to groundwater, once they have confirmed the existence of a certain yield, at a certain depth. The groundwater-use right is accompanied by a prohibition on other groundwater withdrawals in the protective area specified in the right. Any party with legally entitled rights to water that may be adversely affected by the granting of new groundwater-use rights, can oppose the grant, by informing the regional *Dirección General de Aguas* office within 30 days of the publication of the entitlement in the Official Journal[3]. If a petition is opposed, the Regional Director of the *Dirección General de Aguas* can either grant or permit the new water-use right.

There is no property tax on water-use rights. But land is taxed according to its productive value, which accounts for irrigation. There are seven different categories of agricultural land for tax purposes. These range from high quality, irrigated, central valley land to non-irrigated land. Thus the concept of separating land and water has not reached the tax code. There is no sales tax on the transfer of water-use rights, but there are fees paid to lawyers, notaries, and the Real Estate Registry, *conservador de bienes raices* (CBR).

Water User Associations and Irrigation Development

Historically, the development of irrigation in Chile has been dominated by the private sector. Over one million ha. have been developed for irrigation with private investment (Gazmuri, 1994). These were mostly small run-of-the-river systems. Starting around 1930, the government began developing major irrigation infrastructure. Many of these investments were never completed, and since 1945 only one major irrigation system (the Paloma Reservoir system in the Limarí Valley) was built by the government. Also, long-term contracts to recover costs from users were denominated in local currency which has since lost value drastically. In the 1970s both private and public investment in irrigation was absent due to the uncertainty of agrarian reform and government austerity. With more secure land and water rights, and liberalized agricultural policy, private investment in irrigation for high-valued fruit and vegetable crops rapidly expanded in the 1980s.

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[3] Owners of rights to surface water and water user associations have opposed groundwater exploitation near rivers and canals.

All privately developed irrigation systems and many of those developed by the state are owned and controlled by independent water user associations (WUAs). These WUAs are owned and operated by their members, and charge fees based on the their capital and operating costs. The WUAs maintain the canal systems, keep records of rights holders, apportion water to individual rights holders according to their recorded shares, and enforce water rights. The 1981 Water Code specifies rules for the formation, governance, and obligations of these WUAs.

There are three different types of WUAs that are recognized in Chile. A water community, *communidad de agua*, consists of any water users that share a common source of water. They can be chartered and recognized, with formal procedures, but many *communidades de agua* are not. Irrigation Associations, *asociaciones de canalistas*, serve irrigators that share a common canal, and have a legal status which allows them to enter into contracts and receive financing. *Juntas de vigilancia* (JDVs), made up of all users and user associations on a common stream or section of a river, are responsible for administering water use in the river. JDVs control the canal intakes that flow from the river. Some JDVs administer dams for storage of irrigation water. At the national level the Confederation of Canal Operators (CCC) is legally recognized as the representative of most WUAs. According to the CCC, about one half of all WUAs are legally registered with the *Dirección General de Aguas*.

The Ministry of Public Works (MOP), which includes the *Dirección General de Aguas*, has played an important in water management in Chile. Its *Dirección de Riego* (Directorate of Irrigation) is responsible for planning, supervising construction, and operation of public sector irrigation infrastructure. The National Irrigation Commission (CNR) is an interministerial committee chaired by the Minister of Economy with the membership of the Ministries of Finance, Public Works, Agriculture, and Planning. The CNR is the major government entity which determines irrigation policy. Except for recent initiatives in the construction of several large schemes, there has been no public investment in large irrigation projects for the last 15 years (Gazmuri, 1993).

Water Supply and Sanitation

Chile has traditionally had a high level of water and sewerage coverage: 98% of urban and 75% of rural households have had household access to piped water, and 80% of urban households are connected to central sewerage systems. However, in the past fifteen years the water and sanitation services have undergone a major transformation. In 1990, the regulatory functions of the former national water supply and sanitation service, SENDOS, were transferred to the newly created Superintendency of Sanitary Services (SSS). In addition, SENDOS was decentralized into 11 separate, autonomous, regional water supply and sanitation (WSS) companies, along the lines of the Metropolitan WSS Company of Santiago (EMOS) and the WSS Company of Valparaíso (ESVAL). Stock is currently held by the government and CORFO, a publicly owned corporation.

These independent water companies are obligated by law to provide water and sanitation services to the large municipal areas. They are required to deliver full water supply to their concessions 95% of the time. Water rates are based on delivery costs, with a fair return on capital, and reviewed every five years by SSS. A premium is charged in the summer months in order to manage demand during periods of high use. These water companies have inherited the