3 Reforming water policies in Latin America: Some lessons from Chile and Ecuador

Douglas Southgate and Eugenio Figueroa B.

As a sub-discipline, environmental economics is something of an outlier. Whereas economics as a whole focuses on the efficiencies realized if specialization and trade are unencumbered – market functionality, as one might say – economic analysis of natural resource issues is mainly about market failure, such as the inefficiencies that result if a competitive industry treats its adverse environmental impacts as externalities.

To be sure, externalities (both positive and negative) are ubiquitous. Consider the downstream consequences of natural resource use in the upper reaches of a drainage basin. If agricultural chemicals are misapplied or if hillsides are over-plowed, then water is contaminated and sediments accumulate at lower elevations. In contrast, establishing forested strips alongside streams creates important hydrological benefits for downstream populations. As is made clear in any textbook on environmental economics, of which dozens have been published, negative spillovers are excessive because costs are not fully internalized by responsible parties. By the same token, positive externalities are under-produced because suppliers do not capture all benefits.

While market failure is an important cause of environmental deterioration, one must keep in mind that market allocation of natural resources can be efficient, and indeed often is. Moreover, non-market allocation does not guarantee desirable outcomes. To the contrary, the latter approach frequently creates inefficiency, inequity, and damage to the environment.

Non-market allocation of water is an excellent case in point. In nearly every part of the world where water is provided by the public sector, the prices that households, farms, and other consumers pay for this essential resource fall short of the true cost of building, operating, and maintaining the dams, canals, and other infrastructure required for reliable supplies. High subsidies – or, if one prefers, poor cost-recovery – cause waste and misallocation on a grand scale. The beneficiaries of this inefficiency are mainly those who are wealthier – and politically better connected – while the losers are the poor. Furthermore, poor cost-recovery in potable-water, irrigation, and other systems reduces funding for the protection of water sources and the containment of pollution. Thus, the environment suffers.

Removing price distortions may not solve all of the world's water problems. However, supplies of the vital liquid will never be adequate for all humanity in the absence of pricing reform. Distortions in the prices of potable water have been reduced recently in Latin America, frequently (though not always) due to privatization. However, attaining efficient pricing in the irrigation sector, which accounts for a large share of total water use and consumption,[1] is a greater challenge. The problem is that real-estate values, which are highly sensitive to subsidies, tend to fall as cost-recovery improves in irrigation projects. Appreciating this linkage full well, farmers who benefit from under-priced water are seldom enthusiastic about pricing reform.

The disadvantages of subsidized prices and the benefits of reform: potable water in Quito

The inefficiencies, inequities, and negative environmental consequences of under-priced water were all on full display in the capital of Ecuador during the late 1980s. The municipal water company rarely recovered more than 50 percent of its costs. Chronically short of funds, the company did not serve its customers (i.e., those with pipes running into their homes and businesses) well; during some parts of the year, for example, water-supply interruptions occurred daily in many sectors of the city. Even worse, financial constraints prevented the firm from serving all its potential customers;[2] approximately 35 percent of the metropolitan population was unconnected to the municipal system, and instead relied on water delivered by tanker trucks (Carrión 1993). Since this mode of delivery is relatively expensive, prices paid by those households without a piped connection were nearly ten times the prices charged to households who were fortunate enough to be served by the municipal company (Southgate and Whittaker 1994, 72–73).

The neighborhoods which depended on tanker water were generally poorer than the rest of the metropolitan area. Many of these neighborhoods – like the slums which surround many Latin American cities – were formed when squatters had invaded farms on the outskirts of Quito. These new suburban communities petitioned for public utilities, but they lacked political clout and hence waited endlessly to be served. So in the late 1980s, Quito's potable-water subsidies created stark inequities, just as under-pricing has done in metropolitan areas throughout the region before, during, and since. The policy tended to deny access to piped water to the poorest segment of the urban population, which then relied on much more expensive sources (ibid., 73).

Poor cost-recovery has been inequitable in another respect. The subsidies required to fund below-cost supplies exacerbate fiscal deficits. In Ecuador and many other Latin American countries, governments have printed more money to pay for their debts. The resulting inflation, which essentially acts as a stealth tax on savings, is particularly burdensome for the poor, since their earnings tend not to adjust fully to higher living costs and because rising prices tend to ravage any savings they possess. At the end of the day, the poor derive little benefit from subsidies – including poor cost-recovery in potable-water systems – while bearing much of the burden in the form of an inflation tax.

Finally, Quito's policy of under-pricing water during the late 1980s was impossible to justify on environmental grounds. The municipal company struggled to pay for the construction and upkeep of its pipes, pumps, and other infrastructure. As such it had little funding for watershed conservation, which is crucial for averting seasonal and other water shortages. Likewise, nothing was done about wastewater management (beyond channeling untreated sewage into nearby rivers) due to a lack of financial wherewithal.

Potable-water subsidies being inefficient, inequitable, environmentally damaging, and ultimately unsustainable, cost-recovery increased substantially in Quito during the 1990s. By the middle of the decade, prices were generally in line with the cost of water-delivery. A better financial situation allowed the municipal company to provide more reliable service to existing customers (e.g., by reducing the frequency of interruptions), which explains why the public accepted an increase in prices. The company also undertook major expansions of the system which have been enormously beneficial for newly-served neighborhoods whose residents no longer rely extensively on water delivered by tanker-trucks. By 1993, the share of the metropolitan population provided direct service by the water company had risen to 80 percent (Carrión 1993) and was approaching 90 percent at the end of the 1990s.

In Argentina (see Box 3.1), Brazil (Fujiwara 2005), and other parts of Latin America, the extension of municipal systems into impoverished neighborhoods – as happens if privatization or some other reform improves the efficiency with which potable water is delivered – has had a positive impact on public health, although there is limited documentation of this impact in Quito. However, the Ecuadorian capital can point to demonstrable progress on the environmental front. A water fund (FONAG) was created to fund watershed conservation. In addition, wastewater treatment facilities are being constructed for the first time ever in the city. Regrettably, progress on both these initiatives is being stymied because cost-recovery, after improving significantly during the 1990s, has deteriorated in recent years.[3]

Box 3.1 **Public health benefits of potable-water privatization in Argentina**

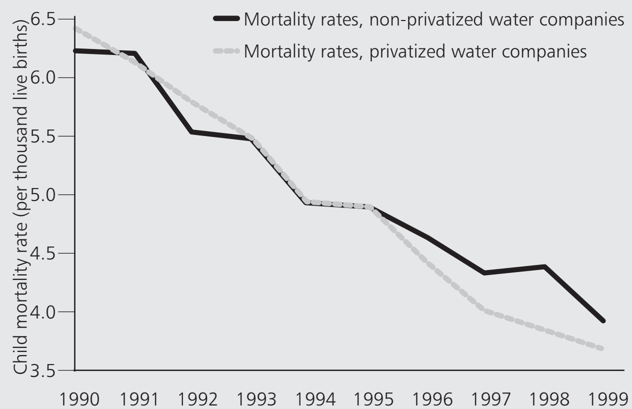
During the 1990s, when the Argentine government sold off a number of state-owned enterprises, legal changes were implemented that allowed for privatization of municipal water companies. Approximately 30 percent of these companies were sold to private operators, while the rest remained in the hands of local government. This change in ownership created a real-world experiment which could potentially reveal the impacts of potable-water privatization on public health. Analyzing data from this experiment, Argentine economist Sebastián Galiani and colleagues Paul Gertler and Ernesto Schargrodsky found that these impacts are positive, especially for the poor.

Since children are especially vulnerable to infectious and parasitic diseases that are contracted as a result of consuming contaminated water, the three economists selected child mortality as the dependent variable in their analysis. In addition, major factors other than water privatization that might have affected mortality – such as per-capita spending on social services by the local government – were included in the statistical model.

The economists' findings comprise compelling evidence that public health improves as potable water systems are privatized. Figure 3.1, taken from their study in the *Journal of Political Economy*, indicates that the trend in child mortality was uniform throughout Argentina through 1995 (when privatization started to occur). At this point, there was no significant difference between areas served by water companies that were later privatized, and areas served throughout the decade by companies controlled by local authorities. The same exact trend continued, neither accelerating nor decelerating, during the second half of the decade in non-privatized settings. But meanwhile, the trend toward lower mortality rates accelerated in privatized settings, which caused statistically significant differences to emerge between the two areas.

Galiani, Gertler, and Schargrodsky estimate that, all else remaining the same, privatizing potable-water delivery results in an 8 percent decline in child mortality. Perhaps because several privatization agreements stipulated that new owners must extend service into poor neighborhoods, the benefits of privatization were found to be especially great there. Indeed, they estimate that privatization reduced child mortality by 26 percent in the poorest areas.

Figure 3.1 **Trends in child mortality in privatized and non-privatized water companies**



Note: There is no precise date of the shift from public to private with the companies involved, but the shift in ownership did occur during the mid-1990s. It is after 1995 (dotted line) when the trend toward lower childhood mortality in privatized settings was observed.
Source: Galiani, Gertler, and Schargrodsky (2005), p.86.

To ensure that these estimated impacts are not spurious, the three economists investigated different causes of mortality. Potable-water privatization was found to be significantly related to fewer deaths from infectious and parasitic diseases. In contrast, there is no correlation between privatization, on the one hand, and mortality having nothing to do with water conditions, on the other. At least in Argentina, then, the conclusion that privatizing the delivery of potable water benefits human health, especially the health of poor people, seems beyond dispute.

Source: Galiani, S., P. Gertler, and E. Schargrodsky (2005).

The disadvantages of irrigation subsidies and impediments to pricing reform: the case of Ecuador

The adverse impacts of poor cost-recovery in potable-water systems correspond directly to the consequences of irrigation subsidies, although the gap between the prices farmers pay and the expense of channeling water to their fields tends to far outweigh levels of subsidization in municipal systems.

In Ecuador, legislation adopted during the 1970s mandates the pay-off over 75 years of a portion of the capital costs of irrigation projects, with no interest charges. The remainder of these costs is completely subsidized. As of 1989, farmer-beneficiaries of public irrigation projects contributed $1.57 per hectare for the infrastructure used to deliver water to their fields – barely 1 percent of actual capital expenses (Southgate and Whitaker 1994, 62). Although the same legislation mandated full recovery of operation and maintenance costs, approximately half of these costs were also subsidized. As irrigation is very capital-intensive, and since 99 percent of expenses were subsidized, overall cost-recovery was well below 10 percent (*ibid*., 64–65).

Paying very little for water, the beneficiaries of public irrigation projects have not had much reason to make the highest valued and best use of hydrological resources. For example, on-farm water efficiencies[4] are very low in Ecuador. For this and other reasons, the return on governmental investment in irrigation has been disappointing, with benefits (which comprise the market value of additional production) equaling no more than half the costs of irrigation during the 1980s (*ibid*., 65–66).

Even though benefits fall well short of costs, subsidized irrigation is highly profitable for its farmer beneficiaries. A hypothetical example illustrates the point. For instance, assume a farmer pays 10 percent of total irrigation costs. Assume also that the value of additional crop production – which is captured entirely by the farmer – is equivalent to 30 percent of those same costs, after an allowance is made for expenditures on other agricultural inputs. In this example, society suffers a loss – the 70 percent of irrigation expenses that is not compensated for by any benefit. However, for the farmer, three pesos come his way for every one peso he spends on water.

This sort of profitability explains why farmers not only seek to maintain existing subsidies, but lobby for new irrigation projects as well. Responding to this political pressure, the Ecuadorian government constructed new systems during the 1980s which had a combined capital cost of US$1.1 billion. Likewise, other projects being designed or given serious study during that same decade had an aggregate capital cost of about US $1.1 billion (*ibid*., 61–62). To put these expenditures into perspective, one needs to keep in mind that Ecuador's national debt in the late 1980s stood at $12.0 billion and its GDP was a little over US $10 billion.

In the early 1800s, classical economist David Ricardo showed that the main effect of subsidizing agriculture is to drive up the value of rural real estate (Ricardo 1965, 33–45). This observation certainly applies to poor cost-recovery in irrigation systems. In Ecuador, price-premiums for irrigated land have been found to range from a little less than US $400 to nearly US $4,000 per hectare and to average nearly US $1,100 per hectare (Southgate and Whitaker 1994, 65). In contrast, non-irrigated farmland was regularly exchanged for US $500 per hectare or less.

The price-premiums for irrigated real estate mainly benefit well-off farmers, and not the rural poor. Indeed, inequitable distribution of the gains from water resource development is all but inevitable. Individuals with good political connections (not least, politicians themselves) are the first to find out about new projects. Before a new irrigation initiative has been publicized, these favored individuals buy land in the area which will be affected, knowing that real-estate values will rise substantially once the initiative is announced. Precisely because of this sort of transaction – as well as the ability of these same people to obtain cheap, government-supplied water for land they have already owned for a long time – the benefits of irrigation are concentrated among the privileged elite, rather than being distributed widely among the rural population.

Finally, irrigation subsidies, like poor cost-recovery in potable-water systems, lead not only to inefficiency and aggravated income disparities in the countryside but also to environmental damage. With the budgets for water resource development used almost entirely to subsidize existing projects and to construct more of the same, technical assistance on the proper use of irrigation water and the management of irrigated soils is chronically modest. In addition, national and regional agencies responsible for water resource development, which have a clear mandate for watershed conservation and pollution-control, have little funding to spare for these activities. Given these conditions, natural resources are wasted, polluted, and otherwise degraded.

In light of all its manifest disadvantages, subsidized irrigation has proven to be remarkably durable – certainly more durable than the policy of under-priced potable water. Modest progress toward rational pricing made in Ecuador during the 1990s was made because of an initiative (underwritten by the World Bank and Inter-American Development Bank) to create local water users' associations. Each of these associations was given exclusive responsibility for operating and maintaining a local irrigation system that had been built by the public sector. Rather than receiving government monies, the new entities were to be financed entirely by fees collected from members.

This initiative, which is similar to the approach followed in a number of Latin American nations, works insofar as devolution of the responsibility for irrigation management improves the quality of operations and maintenance, which in turn enhances farmers' acceptance of higher water prices. So far in Ecuador, a handful of old public projects are now being managed by local associations.

Compared with diminished governmental subsidization of operation and maintenance, which the devolutionary approach has facilitated, a large share of capital costs is unlikely ever to be recovered. Inefficiency is part of the problem. As already indicated, the benefit-cost ratio for public irrigation in Ecuador is approximately 1-to-2, which means that half of the country's expenditures on irrigation

have been lost forever. Furthermore, attempts to make farmers pay for the recoverable remainder are stymied by their desire to avoid a decline in the value of real estate, which is the main asset of most rural households.

Under these circumstances, the prospects for full recovery of the capital costs of irrigation are discouraging in Ecuador.

The imperative of irrigation pricing reform

The impediments to improved cost-recovery in public irrigation projects are daunting, as recent experience in Ecuador shows. However, the issue of pricing reform is hard to avoid, for the simple reason that agriculture uses so much water.

Throughout the world, withdrawals for irrigation and livestock production from rivers, lakes, and streams as well as underground aquifers not only exceed extractions for other specific uses, but are also greater than combined withdrawals for industrial production and households' domestic use (see table 3.1).

The world's high-income nations are exceptional in that agriculture accounts for less than half of total extraction. This is a consequence both of the prevalence of rain-fed farming in temperate settings, such as the American Midwest, and the enormous volumes of water used to cool thermal generating plants and other industrial facilities.[5] In contrast, irrigated agriculture is widespread in Asia and North Africa. As a result, freshwater withdrawals for crop and livestock production exceed 80 percent of the total in these parts of the world. The same level is exceeded south of the Sahara (with South Africa and Botswana as exceptions), largely because there is not much industry and use of water by manufacturers is correspondingly limited.

In Latin America, along with Eastern Europe and Central Asia, freshwater withdrawals also exceed the combined total for other sectors. Needless to say, the proportion of water used in agriculture is small by regional standards in those nations with limited irrigation: 61 percent in Brazil, for example, where more than 95 percent

Table 3.1 **Freshwater withdrawals, by sector and region**

Region	*Agriculture*	*Industry*	*Households*
	Percentage used by:		
Latin America and Caribbean	74	9	18
East Asia and Pacific	81	14	5
South Asia	94	3	4
Sub-Saharan Africa	85	6	10
Middle East and North Africa	88	5	7
Eastern Europe and Central Asia	57	33	10
High-Income Nations	42	42	16
Entire World	71	20	10

Source: World Bank (2005), p.148.

of all farmland is rain-fed (World Bank 2005, 134, 146). In contrast, 84 percent of freshwater withdrawals in Chile – where many coastal areas receive little precipitation and 83 percent of agricultural land is irrigated – are for crop and livestock production (*ibid.*).

In light of the huge volumes of water used by farmers, the issue of irrigation pricing policy goes beyond recovering the cost of canals, pipes, pumping stations, and other infrastructure. Where water is scarce, as it is in most places, inefficient use of the resource in agriculture (which is induced by unrealistic prices) has repercussions for all other sectors. Especially where non-agricultural demand for water is increasing due to population growth, economic expansion, industrialization, and other factors, the opportunity costs of wasting and misallocating irrigation water become enormous. Indeed, it is no exaggeration to say that adequate supplies of clean water will never be provided to the population as a whole if there is no alteration of the pricing policies which enable farmers to neglect these opportunity costs entirely.

Pro-market water policies in Chile

Compared to the situation in most countries, Chile's water policies

are unusually conducive to efficient resource use and development. Property rights are the salient feature of the Chilean regime. Since resource ownership is secure and transferable, markets guide the use of water, including its reallocation when and where appropriate.

In some respects, current Chilean policies are consistent with centuries-old traditions in the country and other parts of Latin America, where the notion of public dominion over water resources was inherited in the legal systems from the Spanish law. In turn, Spanish law inheirited this notion from Roman law, which did not consider continental waters as common resources but rather, considered them to be either public or private. Before independence, local associations of private farmers built, operated, and maintained irrigation canals. With subsequent legal development, however, the central government's role expanded. Chile's first Water Code, adopted in 1951, allowed state authorities to grant concessions to private parties. However, these concessions were transferable only if water was not used in any other activity, which essentially meant that all decisions about resource reallocation were in the hands of the state.

Governmental prerogatives were reinforced and extended in a revamped 1967 Water Code. Under this regime, all private rights were "administrative" – granted by the state for particular uses and entirely subject to public regulation. Moreover, use-rights were subject to expiration and water reallocation was determined by regional plans developed by the government. With the public sector exercising ultimate control over hydrological resources, uncompensated expropriation of water rights (and land) occurred during the latter part of Eduardo Frei's administration (1964 to 1970) and accelerated while Salvador Allende was President (1970 to 1973) (Bauer 1998).

Needless to say, the 1967 Water Code, which closely resembled contemporaneous legislation adopted elsewhere in the region (e.g., Ecuador's 1972 Water Law), was at odds with the free-market orientation that the military government adopted about a year and a half after the 1973 *coup d'etat*. Article 19 of the Political Constitution of 1980 was a clear repudiation of the Frei-Allende approach to water resource development. The Article established that "the rights of individuals over water, reserved or established in agreement with the law, will grant to their holders the property over them." This constitutional principle was put into practice in 1981, when Chile adopted a new water law.

The 1981 Water Code established that individual prerogatives in hydrological resources are property rights in every sense of the term, provided that ownership has been officially adjudicated by Chile's General Water Directorate (DGA). In addition to being permanent, water rights are transferable; sales are allowed either between farmers or between an irrigator and a non-agricultural user. Water rights, enforced by the DGA, can also be mortgaged, just as real estate can be. Furthermore, they cannot be expropriated without due compensation.

Significantly, the DGA cannot refuse to grant new rights if no one already owns the resource which is being claimed.[6] Hydroelectricity producers and other non-consumptive users are entitled to legal recognition and protection of their diversions from streams and rivers, provided that equal volumes are returned to the same channel. For consumptive uses, including irrigation, individual owners are entitled to withdraw a specific volume per time-period, although proportional reductions occur when stream-flow is unusually low (Hearne and Donoso 2005).

The 1981 Code mandated formal water rights for historical users – mainly irrigators (including small farmers who had benefited from the agrarian reforms of the Frei and Allende administrations), potable-water companies, and mines. Once this category of ownership was recognized, the DGA could create new rights in response to petitions submitted by resource users. The procedure governing the latter sort of adjudication begins with publication of proposed water rights in the *Diario Oficial* (i.e., the official journal of the country). If there are rival claimants, then the directorate organizes an auction, and the highest bidder takes ownership.

Throughout Chile, water users have responded to the 1981 Code

by winning formal recognition of their historical rights and by acquiring resources which are not yet claimed by anyone else. But commercial water transactions, which the same law makes possible, have been less widespread. Such transactions are particularly rare where hydrological resources are abundant – in those parts of southern Chile with elevated precipitation, for example.

One part of the country with regular purchases and sales of water is the Limarí Valley, north of Santiago, where irrigated production of wine-grapes and other highly-valued crops has increased dramatically in recent years (Hearne and Easter 1997). From 1980 through 2000, nearly 28 percent of all water rights exchanged in the watershed were bought and sold independently of land transfers, with old and new owners making use of a market for permanent transactions created for exactly this purpose. In addition, a spot market exists in the Limarí Valley for resources used during a single growing season. In 1999–2000, for example, approximately 14 percent of the volume allotted to water users' associations in the region was exchanged in this market. During the unusually dry 1995–1996 season, this share was 21 percent (Cristi *et al*. 2000).

These transactions could not occur without the enabling legal framework created by the 1981 Water Code. In addition, water markets function well in the Limarí Valley because buyers and sellers have confidence in water users' associations, which maintain records of purchases and sales (*ibid*.). Another factor of great importance for the spot market is infrastructure, specifically the Paloma Irrigation System, which is the largest in Chile and the second largest in Latin America. Comprising three dams – Paloma (with a storage capacity of 750 million m^3), Cogotí (150 million m^3), and Recoleta (97 million m^3) – as well as an extensive network of canals, this system regularizes the supply of water and constitutes a guarantee to buyers that spot-market purchases will actually be delivered.

The organizational and institutional conditions that facilitate the spot market in the Limarí Valley are not fully satisfied in many other parts of Chile. As a result, exchanges of longer-term water rights have been the national norm, with these rights usually reallocated from irrigated farming to higher-valued non-agricultural uses. The Upper Mapocho Basin, near the Chilean capital Santiago, is a good example. In this area, sales to potable-water providers and real-estate developers accounted for 76 percent of the water rights traded from 1993 through 1999 (Donoso *et al*. 2001).

Notwithstanding the policy reforms which have made it possible for water resource use and development to be guided by market forces, new issues have arisen since promulgation of the 1981 Water Code. One of these issues is the monopolization of natural resources, especially in the hydroelectricity sector.

Taking advantage of its mountainous terrain and the abundance of water in many settings, Chile generates most of its electricity from hydro sources. Energy demand has risen substantially since the mid-1980s, as the national economy has expanded at a rapid pace. The 1981 Water Code encouraged hydroelectricity generation by creating property rights for non-consumptive uses of water, as discussed above. More than four-fifths of all such rights have been acquired by ENDESA, a Spanish firm that has invested heavily in the Chilean energy sector.

That ENDESA owns such a large portion of the resources that are suitable for hydroelectricity production raises obvious monopoly concerns. Similar concerns have been expressed about other categories of water rights, although the concentration of resource ownership resulting from the adjudication of historical ownership and new claims has been less extreme. At the urging of Chile's competition commission, the DGA has responded to ENDESA's dominance of hydroelectricity by refusing to grant new non-consumptive rights. This move has been supported by the Constitutional Court, which has ruled that the 1981 Code can be changed to allow additional conditions (including those meant to curb monopolization) to be placed on petitions for new water rights. Precisely this change was effected with new legislation in 2005.[7]

This same legislation created an additional tool for dealing with the concentration of hydrological resources in few hands. As of 1 January 2006, non-consumptive rights that are not being used – which according to the Ministry of Public Works exceed 80 percent of all such rights adjudicated by the DGA (Ministerio de Obras Públicas 2005) – will be subject to a fee. According to one consulting firm, ENDESA's payments for 2006 will be about US$2.6 million (Tanner Análisis 2005).

These recent modifications of the 1981 Water Code do not represent a repudiation of Chile's approach to water resource development in the past 25 years. With appropriate correction of the law to deal with excessive concentration of resource ownership, water rights remain secure and transferable, which means that allocation will continue to be guided by market forces. This market-driven system is highly advantageous in a country that has experienced rapid economic growth in recent decades, with direct consequences for water demand in agriculture, mining, and other part of the economy (Brown 1996; Figueroa *et al*. 1996). Indeed, it is doubtful that the competition over water resources inevitably created by economic expansion could have been resolved as effectively in the absence of policies that stress ownership and markets.

Summary and conclusions

Where water has grown scarce due to demographic and economic expansion, markets have proven to be an effective tool for resource allocation, including in developing nations. Markets require an enabling legal framework, which Chilean water law provides. In addition, the commercial exchange of water and resource rights is particularly active – both where demand is driven by highly-valued uses and where transactions costs have been lowered by institutional and infrastructural development, of the sort that has taken place in the Limarí Valley.

Other Latin American countries have attempted to replicate Chile's approach. Mexico's Water Law of 1992 resembles the 1981 Code by providing for the registration and transfer of water rights.

During the 1990s, Peru tried to adopt a water law that was consistent with the country's pro-market policies (Juravlev 2004).

But for the most part, the Chilean approach remains exceptional in the region. An objection frequently made by opponents of private water rights is that indigenous peoples are disenfranchised. However, this criticism is unjustified, since the combination of the 1981 Water Code and legislation subsequently adopted to protect such groups has given their rights precedence over other resource claims (Peña 2004).

Moreover, the failure to convert limited concessions for water use (of the sort that Chile had while the 1967 code was in force, and still exist in much of Latin America) into full-fledged water rights prevents everyone – including concession-holders – from capturing the gains created when markets are allowed to allocate resources to their most highly valued uses.

For example, an advantage enjoyed by those whose historical claims are formally adjudicated is that, simply by taking their rights to market, they can benefit from the efficient reallocation of hydrological resources. For example, irrigators who sell their rights to potable-water providers capture some of the value created when water is distributed to households rather than being applied to crops. But beyond this specific benefit, efficient markets for water and other factors of production – which can exist only if resource rights are permanent and transferable – are every bit as instrumental as trade liberalization in creating the right conditions for across-the-board economic growth.

As made clear in the case of Ecuador, subsidies and other forms of non-market allocation are not only financially unviable and economically inefficient, but are often injurious to the poor. By the same token, the case for water resource development driven by market forces is unassailable, as demonstrated amply by Chile's experience during the past 25 years.

Notes

1. Water use is either consumptive or non-consumptive. For example, the portion of water that is diverted from a stream, applied to farm fields, and then allowed to drain back into the same stream is classified as non-consumptive use, even though its quality may be diminished because it contains dissolved nutrients and suspended solids. The remainder of the diverted water, which evaporates or is absorbed by harvested crops, falls in the category of consumptive use.
2. The policy of selling potable water too cheaply sometimes created inefficiencies of an entirely different kind. For example, investments in infrastructure were not always constrained much by financial considerations, particularly when the national government paid for the difference between customers' payments and system costs. Under this circumstance, Quito's water company was known to use U.S. technical coefficients when deciding on the dimensions of pipes and machinery required for system extension. The capital expenditures resulting from this practice were excessive since per-household water consumption in the United States is several times per-household consumption in Ecuador (where extensive lawns, swimming pools, etc. are rare).
3. The resurgence of potable-water subsidies appears to be a consequence of populism. In recent elections, various mayoral candidates have promised cheap public utilities, including drinking water, for low-income districts. An upshot of this political competition is that 800,000 people in southern Quito no longer face any sort of volumetric tariff, but instead pay a uniform household-level fee of $5/month, which represents a very low level of cost-recovery.
4. On-farm water efficiency is defined as evapo-transpiration divided by total water delivered to the head of the main farm ditch.
5. As a rule, industrial cooling is a non-consumptive use of water. It usually is non-polluting as well.
6. The DGA can declare, however, that an aquifer is fully exploited and, on this basis, refuse to permit new withdrawals from the underground resource.
7. Specifically, the change was enacted with the passage of Law 20.017, on 11 May 2005.

References

Bauer, C. (1998). *Against the Current: Privatization, Water Markets, and the State in Chile*. Boston: Kluwer Academic.

Brown, E. (1996). "Disponibilidad de Recursos Hídricos en Chile en una Perspectiva de Largo Plazo," in O. Sunkel (ed.), *Sustentablidad Ambiental del Crecimiento Chileno*. Santiago: Universidad de Chile, pp. 191–213.

Carrión, R. (1993). "Evaluation of the Technical Assistance Provided by USAID/Ecuador and RHUDO/SA through the WASH Project to Quito's Municipal Water Company," U.S. Agency for International Development, Quito.

Cristi, O., S. Vicuña, L. de Azevedo, and A. Baltar (2000). "Mercado de Agua para Irrigación: Una Aplicación al Sistema Paloma de la Cuenca del Limarí, Chile," World Bank-Netherlands Water Partnership Program (BNWPP) Trust Fund, Washington.

Donoso, G., J. Montero, and S. Vicuña (2001). "Análisis de los Mercados de Derechos de Aprovechamiento de Agua en las Cuencas del Maipo y el Sistema Paloma en Chile: Efectos de la Variabilidad en la Oferta Hídrica y de los Costos de Transacción," XI Jornadas de Derechos de Aguas, Universidad de Zaragoza y Confederación Hidrográfica del Ebro, Zaragoza, España.

Figueroa, E, R. Alvarez, G. Donoso, J. Muñoz, and J. Lagos (1996). "Sustentabilidad Ambiental del Sector Exportador Chileno," in O. Sunkel (ed.), *Sustentablidad Ambiental del Crecimiento Chileno*. Santiago: Universidad de Chile, pp. 47–86.

Fujiwara, T. (2005). "A Privatização Beneficia os Pobres? Os Efeitos da Desestatização do Saneamento Básico na Mortalidade Infantil," Facultade de Economía, Universidade de São Paulo.

Galiani, S., P. Gertler, and E. Schargrodsky (2005). "Water for Life: The Impact of the Privatization of Water Services on Child Mortality," *Journal of Political Economy*, vol. 113, pp. 83–120.

Hearne, R. and K. Easter (1997). "The Economic and Financial Gains from Water Markets in Chile," *Agricultural Economics*, vol. 15, pp. 187–199.

Hearne, R. and G. Donoso (2005). "Water Institutional Reforms in Chile," *Water Policy*, vol. 7, pp. 53–69.

Juravlev, A. (2004). "Introducción," in *Mercados (de Derechos) de Agua: Experiencias y Propuestas en América del Sur* (Serie Recursos Naturales e Infraestructura Nº 80), CEPAL, Santiago.

Ministerio de Obras Públicas, Transporte y Telecomunicaciones (2005). "MOP Celebra Junto a CONAMA Aprobación de Ley que Modifica Uso de Aguas." http://www.moptt.cl.

Peña, H. (2004). "Chile: 20 Años del Código de Aguas," in *Mercados (de Derechos) de Agua: Experiencias y Propuestas en América del Sur* (Serie Recursos Naturales e Infraestructura Nº 80), CEPAL, Santiago.

Ricardo, D. (1965). *The Principles of Political Economy and Taxation*. London: Dent and Sons.

Southgate, D. and M. Whitaker (1994). *Economic Progress and the Environment: One Developing Country's Policy Crisis*. New York: Oxford University Press.

Tanner Análisis (2005), "Endesa pagará US$ 2,6 millones por derechos de agua no usados." 18 March. Online: http://www.elmostrador.cl/c_economia/tanner/t050318.pdf (visited February 14, 2006).

World Bank (2005). *World Development Indicators, 2005*. Washington, DC.