Water Economics and Financing

Water Markets in Integrated Water Management

Water Resources Management in California: The Legacy of Dysfunctional Institutions

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Water Resources Management in California: The Legacy of Dysfunctional Institutions

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- The distinctive features of water
- The consequences
  - Fragmentation
  - Public ownership
  - Absence of coordination and economic regulation
- Incoherence in water rights
  - Surface water rights
  - Groundwater rights
  - Quality-quantity trade-off
- Consequent limitations on water marketing
- Jurisdictional Fragmentation
- Decision-making gridlock

- Every five years, the California Department of Water Resources (DWR) releases a report, Bulletin 160, entitled *California Water Plan Update*.
- The most recent, issued in 2005, consists of three large volumes. It presents detailed assessments of future demands and supplies of water in each of the hydrologic regions of California running to 2030, and goes on to outline a portfolio of strategies for bridging the projected shortfall of supply relative to demand.

- An unwary reader would certainly be forgiven for thinking that there is a significant degree of water resources planning and high-level coordination of management in California. This is not true.
- There is no effective management or co-ordination of water resources planning in California.
- Water is a largely unregulated resource, from an economic perspective
- The existing water rights laws are seriously dysfunctional.
- Water marketing is hobbled.
- The water resource management institutions are fragmented and incoherent.
- There is not an effective mechanism for making decisions on tradeoffs between quantity and quality.

- While it has some idiosyncratic features, California is not untypical of many other western states in facing these problems.
- They are not happenstance; they reflect some fundamental features
  - (a) Of water as an economic commodity
  - (b) Of water institutions as a historical legacy
  - (c) Of US federalism, legal approaches, and land use planning.
- Because of (a, b), the same problems may arise elsewhere, including in Spain.

Distinctive features of water

- Because of its importance – for life, for economic prosperity in arid areas – water has a distinctive and powerful emotional significance. This attribute changes the economic calculus.

- This is not the only way in which water is distinctive as an economic commodity.

Distinctive cost structure

- Compared not only to manufacturing but also other public utilities, surface water supply is exceptionally capital-intensive.
  - In the US, operating costs are only about 10% of total costs for water supply, 32% for natural gas, and 57% for electricity.
- There are significant economies of scale.
- The capital assets cannot be used for another purpose or moved elsewhere.
- The physical capital in surface water supply is exceptionally long-lived.

Cost structure complicates financing

- The capital intensity and longevity of physical capital create grave problems of cost allocation and make financing hard.
- If the costs were mainly operating cost it would be very simple to rely on “the user pay principle” and pay-as-you-go financing.
- As it is, the capital intensity and capital longevity mean make it very hard to have “user pay.”
- One ends up relying heavily on transfers:
  - between one group of users and on other
  - between one generation and another

Consequences

- The predominance of capital costs, combined with the physical longevity of the capital, encourages:
  - collective provision of surface water supply rather than individual self-provision
  - public rather than private (investor-owned) provision.
- Hence, water supply is overwhelmingly public
  - Publicly owned utilities provide 85% of US population with water (95% of urban population), but only about 40% of population with electricity.

- The heightened concern about water led to a profusion of small, local water supply entities (both urban and agricultural), rather than a few broad providers.
  - In California, there are 78 retail urban water supply agencies with > 100,000 connections versus only 8 retail electricity supply agencies with >100,000 connections.
  - In the west, towns already existed when electricity was introduced; with water supply, the town and the water supply developed at the same time.
- The supply of water to both urban and agricultural users is highly fragmented

Retail vs wholesale

- At the retail level, water is supplied through many, highly-localized, small distribution systems. Same is true for agricultural supply.
- Urban Southern California is served by a large regional *wholesale* supplier (MWD).
- The federal Central Valley Project and the State Water Project serve as wholesale suppliers of irrigation water (provide ~24% of irrigation water used in California)

Co-ordination

- MWD provides coordination and planning for retail urban water agencies in Southern California; there is an interconnected supply system.
- There is no analog in the rest of California.
- On the agricultural side, the two large water projects have a more hands-off relationship with the retail supply agencies, and do not provide coordination or planning.
- DWR has no coordination or other authority over the individual agencies.

Who does have authority?

- For water rights, the State Water Resources Control Board (SWRCB).
- For health regulation of drinking water quality, the State Department of Public Health.
- For economic efficiency, pricing, demand forecasting, supply planning, etc – virtually nobody has authority.
  - The PUC's economic regulation applies only to investor-owned utilities.
  - Since water is mainly public, it escapes this.

- The original rationale for regulation in the early 1900s was oversight of pricing to make sure that excessively high prices were not charged by private utilities. It was felt that this was not a problem with publicly owned systems
- But, following the oil crisis in the 1973, regulation of private electric and gas utilities broadened its scope to focus on efficiency: sound demand forecasts, wise investment planning, good pricing policies, etc. In California, the regulation was extended to public electric and gas utilities – but not to water.
- As a result, there is no mandate for economic efficiency in water. The lack of economic regulation for water is a severe shortcoming.

Incoherence in water rights

- While surface water is regulated the lack of monitoring of most surface water diversions undercuts its effectiveness.
- Groundwater extraction is essentially unregulated and unmonitored.
- Water rights law (for surface water diversions) and water quality law are administered separately, in an uncoordinated manner.

- Surface water is governed largely by appropriative water rights, with priority based on the date of the original diversion.
  - However, in most cases there is no reporting or monitoring of actual diversions.
  - The reality is more like an informal system of water rights or, at worst, a free-for-all.
  - If there is a reduction in streamflow due to climate change, the absence of a reliable record on who diverted what will surely lead to litigation and chaos. There will not be a sound basis for adjusting water rights.

- Groundwater is treated separately from surface water.
- The SWRCB's authority does not cover groundwater.
- With some qualifications, groundwater law essentially allows the owner of the overlying land to extract whatever amount he wants.
- The counties have some authority to regulate groundwater, but this is very weak.
- Otherwise, while groundwater extraction in urban Southern California has been adjudicated, groundwater extraction in the agricultural areas is essentially unregulated
- It is also unmonitored -- monitoring has been vigorously opposed.

- The failure to integrate or coordinate groundwater and surface water is damaging.
- Groundwater extraction can affect streamflow but, while diversions from a stream are regulated by SWRCB under surface water law, the groundwater extraction is generally immune to SWRCB control.

Water quantity versus quality

- One of the major issues today is how to protect (or restore) aquatic ecosystems.
- In many areas, water diversions are a major contributor to the impairment of aquatic ecosystems: too little water is left in the stream, and/or the water temperature in the stream is harmful to fish because of dams and water diversions.
  - Glen Canyon Dam and Colorado River in Grand Canyon
  - Mono Lake in California

- As a result, the major management issue is how to trade-off water supply for extractive users (irrigation, urban & industrial use) and hydropower versus protection of the in-stream aquatic environment.
- This is hampered by the fact that different bodies of law are involved
  - State water rights law for diversions requires that water be put to beneficial use but do not encourage the making of tradeoffs among competing uses.
  - Federal laws (Clean water Act, Endangered Species Act) for environmental water quality: no federal authority over diversions.
  - The integration of these two bodies of law theoretically occurs through SWRCB but this has not yet been accomplished in practice.
    - Under a judicial ruling, it is supposed to deal with them separately and sequentially.

Water Marketing

- Water marketing was predicted in 1976 to be something that California needed.
- However, it did not begin to occur on regular basis until after ~ 1996.
- It exhibits two distinctive features:
  - Some of the districts that economists predict would be major sellers have not been, and other districts that are unlikely to be sellers have actually been active sellers
  - Over 80% of the sales are short-term (1 year or less) leases.

What function does water marketing serve?

1. Short-run operational flexibility (within the growing season)
   - Within season sales and swaps
2. Hedging against hydrologic variability
   - One-year leases signed before the irrigation season, but not repeated for multiple years in a row
   - Dry-year contracts
3. Long-run reallocation of water
   - Long term leases
   - Permanent sales
   - Land sales

>50% of what happens is (1); ~ 30% is (2); < 20% is (3).

Also, transfers potentially involving groundwater impacts have proven politically explosive.

Questions

- Why do some districts sell, but not others?
- Why is such a small portion long-term transfers?
- Does it matter that such a small portion is long-term transfers?

- Answers have to do with flaws and imperfections in existing system of water rights

Why few long-term transfers?

- Because 1-year transactions do not require solid proof of prior diversions.
  - The fact that appropriative rights are ill-defined and not effectively adjudicated in many cases is an impediment to long-run transfers
- Because 1-year transactions escape environmental review
  - SWRCB does not have any standardized procedure – each is done on a one-shot basis.
  - Moreover, the larger issue of the environmental impacts of water diversions on water quality and fish in the Delta remain unresolved.
- Because the lack of an effective regulatory framework for groundwater leaves a void.

- Does it matter?
  - Yes:
  - While the operational flexibility associated with 1-year exchanges is valuable, this does not help deal with the larger need for reallocation of water. With urban population growth, and with climate change reducing our effective water supply, this becomes all the more important.
  - Also, with climate change making surface water less reliable, the issue of groundwater regulation will have to be addressed.
    - Increased use of groundwater banks in recent years makes this potentially troublesome.

- Water marketing is not a substitute for repairing dysfunctional water rights institutions and administration.

- Rather, fixing dysfunctional water rights institutions and administration is a precondition for water marketing to provide the reallocation of water that will be needed.

Fragmented Jurisdictions

- There is no river basin management. There is no single agency with the authority to manage land use within an entire watershed.
- Land use is controlled at the very local level (county & city), and caters to local interests. It typically does little to constrain or shape growth.
- Until very recently, it has not been integrated with water supply planning. Urban development has taken place without knowing whether an adequate water supply is available. This is now beginning to change in California, as a result of legislation which had not been expected to be very effective.

Gridlock in decision-making

- The major issue in California water since ~1930 has been whether it is possible to undertake large scale diversions of freshwater from the San Francisco Bay/Delta without excess harm to the aquatic ecosystem.
- Once diversions began in 1949, the state was required to set environmental quality standards which would constrain the diversions.
- Almost 60 years later, it still has not made this decision. There has been a continuing deadlock among the stakeholders.
- SWRCB, which is supposed to make this decision, is weak and unwilling/unable to act.
- The political leadership of the state has so far been unwilling to intervene, allowing the deadlock to persist.

- There are two core issues
  - What actions are needed to protect the ecosystem?
    - Reduce diversions
    - Build new conveyance facilities
    - Engage in environmental restoration
    - Require increased conservation
  - Who should pay for these?
- So far there has been potential (though not yet actual) agreement on the first, but none on the second.

Hence a system marked by

- There is no effective management or co-ordination of water resources planning in California.
- Water is a largely unregulated resource, from an economic perspective
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Facing the future

- Armed with a legacy of fragmented and dysfunctional institutions, we face multiple future challenges:
  - Population growth and changing land use
  - Environmental restoration and balancing the interests of instream environmental protection against those of water diversions
  - Deteriorating infrastructure
  - Climate change

Climate change

- Not just precipitation but also runoff (which is sensitive to temperature).
- Not just annual precipitation. Timing of precipitation matters
  - Precipitation during the growing season.
  - Can have both more winter precipitation and more summer time drought.
  - With snow-reliant systems, what matters is water stored in snow pack at the beginning of spring. Can have more winter precipitation and less water supply available for springtime and summertime use unless costly extra storage is developed.
- Temperature is often the more powerful influence on effective water supply than precipitation.
- With water supply, the cost is mainly the infrastructure for storage, conveyance and treatment, not water per se.

Water supply impacts, continued

- Key fact of future impacts of climate change is that they are superimposed on a larger population, possibly more prone to live in vulnerable locations.
  - Climate change exacerbates the stress caused by population growth and changes in land use.
  - Climate change causes an *intensification* of extreme events.

Water, continued

- Because of population growth, urban demand for water in Southern California will be 60% larger in 2085 than now. Climate change reduces effective supply by 10-20%.
- Compared to without climate change in 2085, with A1Fi shortages that require rationing occur twice as frequently (1/3 instead of 1/6 of years) and are more intense (1/3 greater loss of consumer's surplus).
- Thus, looking at the median or average year is misleading.

Water: institutional dimension

- Rights to divert surface water in the US West are rights to divert in specific time period, typically April – September.
- With climate change and melting of snowpack in snow-dependent systems, this streamflow will decline significantly.
- Will water rights adjust? If not, what happens to water transfers?

An uncertain future

- Eventually, the stresses will become sufficiently strong that fixes for some of the dysfunctional features of the present system will surely occur.
- How quickly this will happen – and how large will be the costs generated by the dysfunctional features before they are reformed – is not clear.