

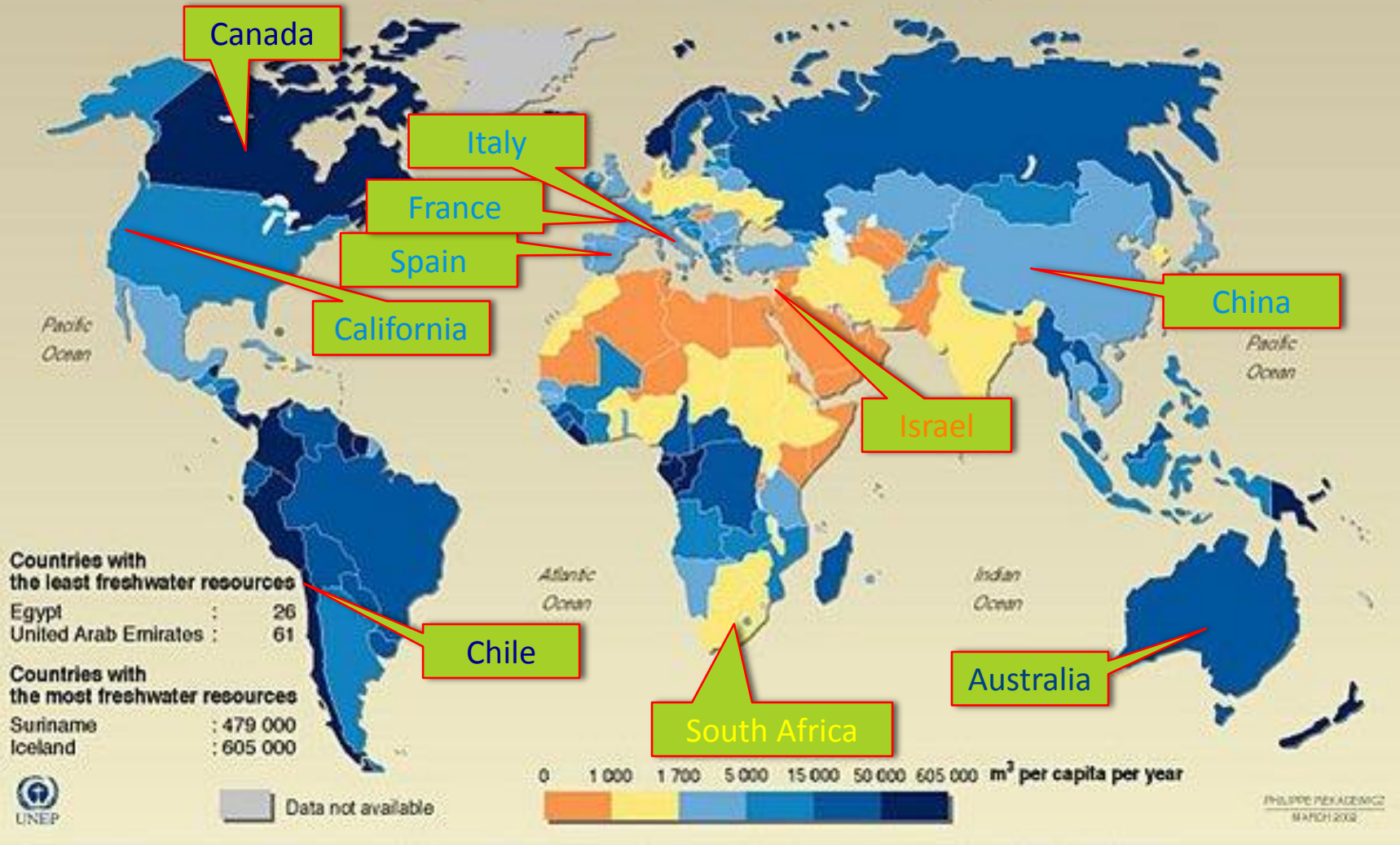
Water Pricing for a Dry Future

Summary and synthesis of
experiences from Abroad

Ariel Dinar and David Zilberman

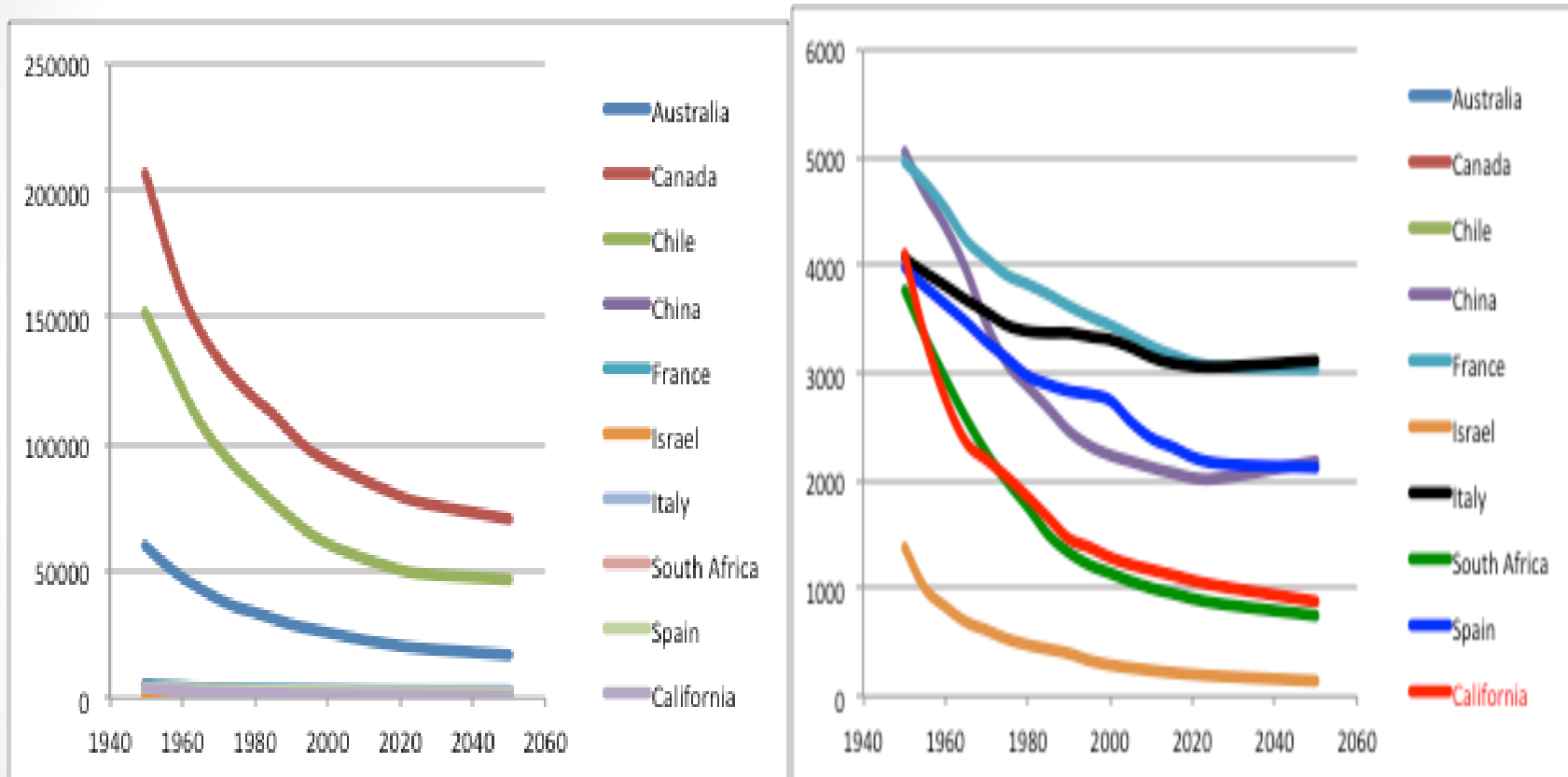
Availability of Freshwater in 2000

Average River Flows and Groundwater Recharge



Source: World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life, World Resources Institute (WRI), Washington DC, 2000.

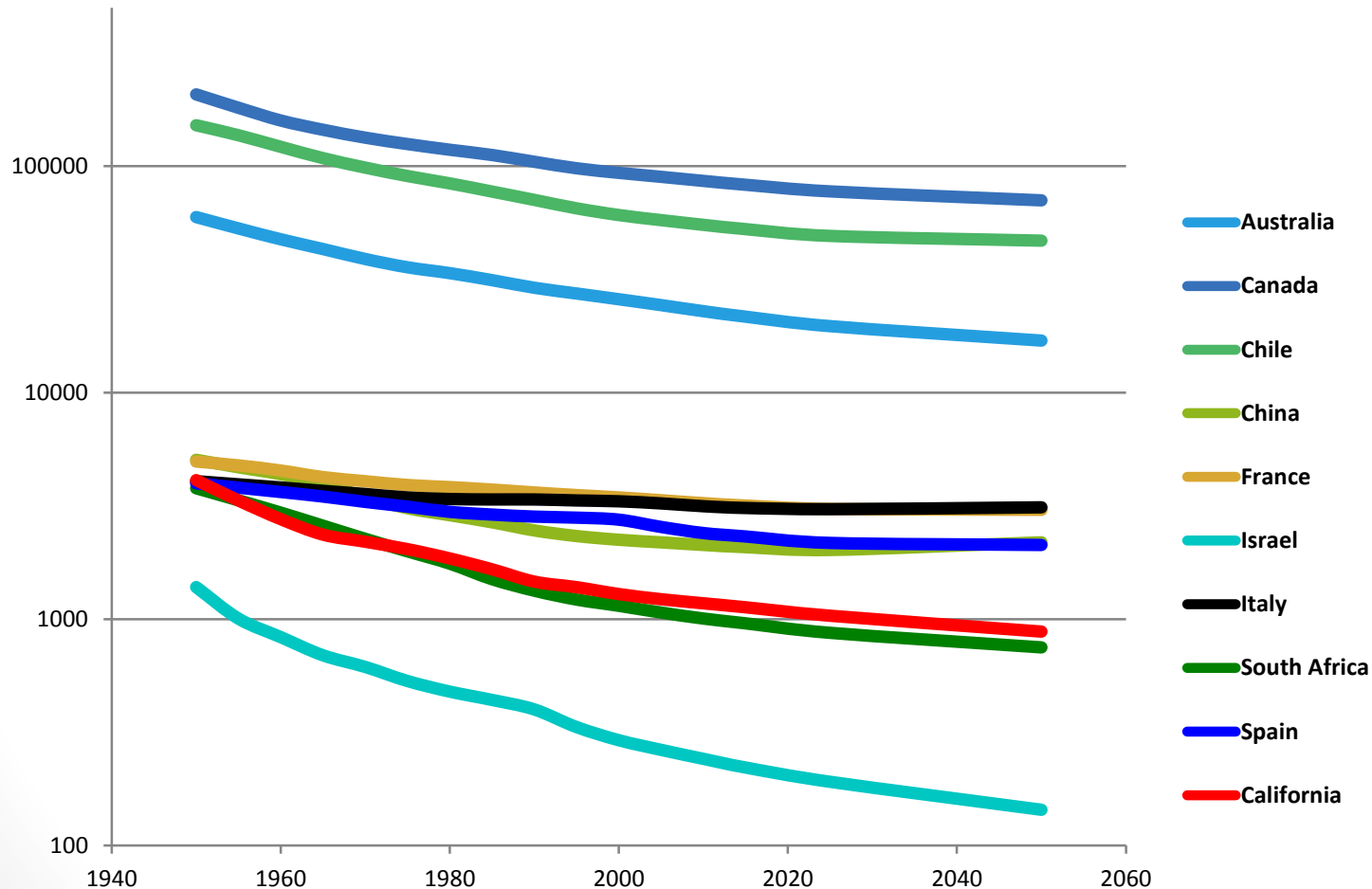
Water availability over time



Sources:

- (1) Available water resources in countries except California: CIA Sourcebook 2015.
- (2) <https://www.cia.gov/library/publications/the-world-factbook/fields/2201.html>
- (3) Population in all countries except California: United States Census Bureau <https://www.census.gov/population/international/data/idb/worldpopgraph.php>
- (3) Long term water resources availability in California: Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, B. Thompson, *Managing California's Water: From Conflict to Reconciliation*. San Francisco: PPIC, 2011.
- (4) Population in California: California Department of Finance, Report P-1: Summary Population Projections by Race/Ethnicity and by Major Age Groups.

Water Availability over time (Logarithmic scale)



Source: Authors elaboration based on data in previous slide

Ag Water use (%)

Country/State	Ag Water use of available water withdrawal (%)
Australia	66
Canada	12
Chile	83
China	66
France	9
Israel	52
Italy	24
South Africa	60
Spain	63
California	80

Source:

For California: http://www.ppic.org/main/publication_show.asp?i=1108

For rest: FAO AQUASTAT

Australia

- Federalism
 - Great variation over territories in population, precipitation and evaporation
- Millennium Australian Drought (2001-2009)
- Common national water pricing framework (2010 National Water Initiative-NWI)
 - Prices based on volumetric use
 - Water rights separated from land rights
 - Trade in rights was encouraged
 - Prices of water entitlements
 - Prices faced by end-users
 - Delivery services, infrastructure access (irrigators, environmental reserves, bulk urban water suppliers)
 - For residential and other urban users prices include access to the resource itself

Australia: Examples of 2012/13 tariff

Territory	Tariff Structure	Fixed charge (\$AU)	Block charge (\$AU/cubic meter)
Australia Capital Territory	2-part with 2 inclining blocks	100	2.43 4.86
New South Wales	2-part	19-167	434.92-606.70
Northern Territory	2-part	263	1.73
Quinsland	2-part Fixed charge 2-part with two inclining blocks	201 681 590	3.27 - 2.10-3.30
Victoria	2-part with 3 inclining blocks	82-215	1.75 2.13 3.44 1.38 1.84 3.67

1\$AU=1-0.9 \$US in 2012/13

Source: Table 2.1 Crase et al. (2015)

Canada

- Federalism
- Well water-endowed
 - Deteriorating infrastructure of water and wastewater
- Excessive use of water
 - Inadequate water conservation practices
 - Low prices
- New initiatives
 - British Columbia
 - Water Sustainability Act: regulating SW and GW withdrawals
 - Intention to raise water use fees
 - Other provinces
 - Moving towards higher fees for self-supplied water users
 - Full cost accounting
 - Developing pricing structures for collection and treatment of storm runoff water

Canada

Province	% Pop metered	% Pop flat rate	Aver Marginal Price \$CA/m ³ (2006)
Quebec	16.5	88.5	0.91
Ontario	91.2	88.4	1.95
Manitoba	97.2	87.8	3.07
Saskatchewan	98.2	94.4	1.75
Alberta	84.8	90.7	1.78
British Columbia	32.6	83.4	1.28

1.00 CA \$ = 0.88 US \$ in 2006

Source: Table 4.1 in Renzetti and Dupont (2015)

China

- Types of fees included in water pricing frameworks at present:
 - Resource fees; Supply fees; Urban supply fees; Wastewater collection and treatment; Pollution discharge
- Time line:
 - 1949-1965 Era of no change
 - 1965- lower service charges (ability to pay)
 - 1980s Resource fees introduction
 - Late 1990s Wastewater collection and treatment fees
 - 2000s- Comprehensive water pricing systems
- Each province issues the parameters of the pricing scheme
 - Resource fee used to be levied by sector. Since 2014 it is similar for all sectors.
 - Urban schemes include 2-3 blocks. Agricultural schemes allow to exceed quota for a fine.

France

- Abundant and unequal distribution of water over time and space
- EU Water Framework Directive
 - Full cost recovery
 - Full cost = Full use cost + Environmental Externalities
 - Full use cost (Economic Cost) = Economic Externalities + Opportunity cost + full supply cost
 - Full supply cost = Capital Charges + O&M costs
 - Water pricing is managed by water districts

Structure	2003 (% of districts)	2013 (% of districts)
Declining tariffs	36	4
Increasing rates	1	29
Flat rates	3	1

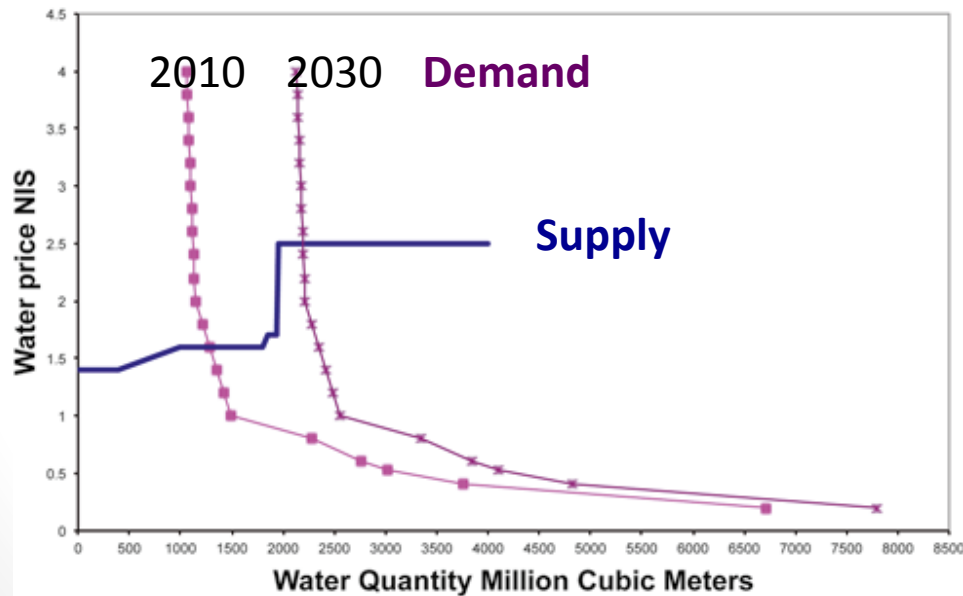
Source: Table 8.3 in Montginoul et al. (2015)

France

- Emergence of social issues
 - Reducing the water bill for targeted population
 - Rebates on Water Bills
 - Challenges with increasing block tariffs for apartment buildings
 - Supporting income of targeted populations while charging fully for water
 - Reducing bills for all and introducing taxation
 - High connection level, but little knowledge about tap water is used

Israel

- Pricing system accounts for various types of water (fresh, treated, desalinated) for various uses (irrigation, household, industrial, environmental)



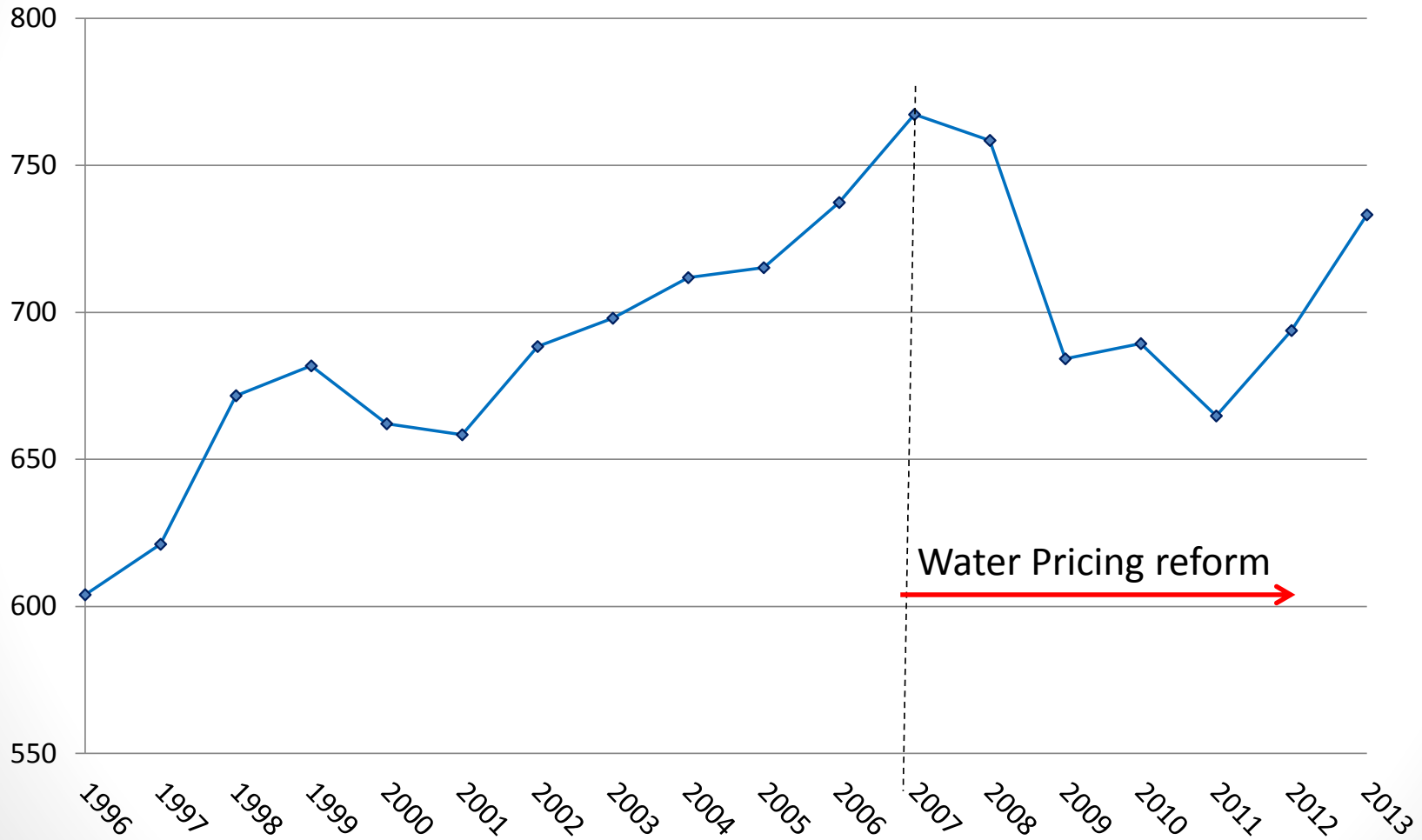
Pricing system moved
From a subsidized to a
Financially balanced
closed system

Focus on demand
Management and
supply augmentation

Source: Fig 10.6 in Becker (2015)

Israel

Domestic Water Consumption



Source: Presentation by Tsur (2016)

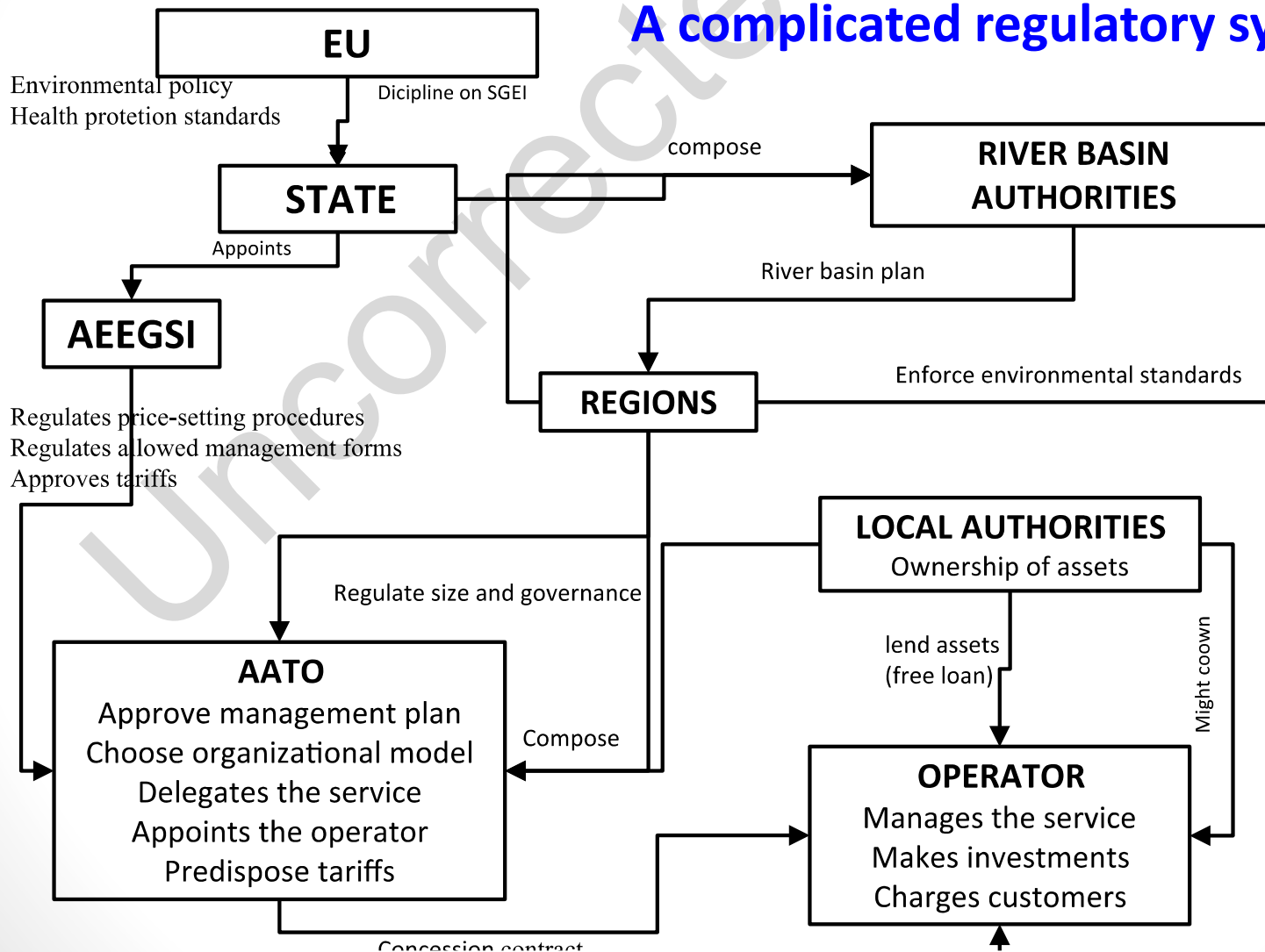
Italy

Full cost recovery

Financial sustainability

MTI → MTT

A complicated regulatory system

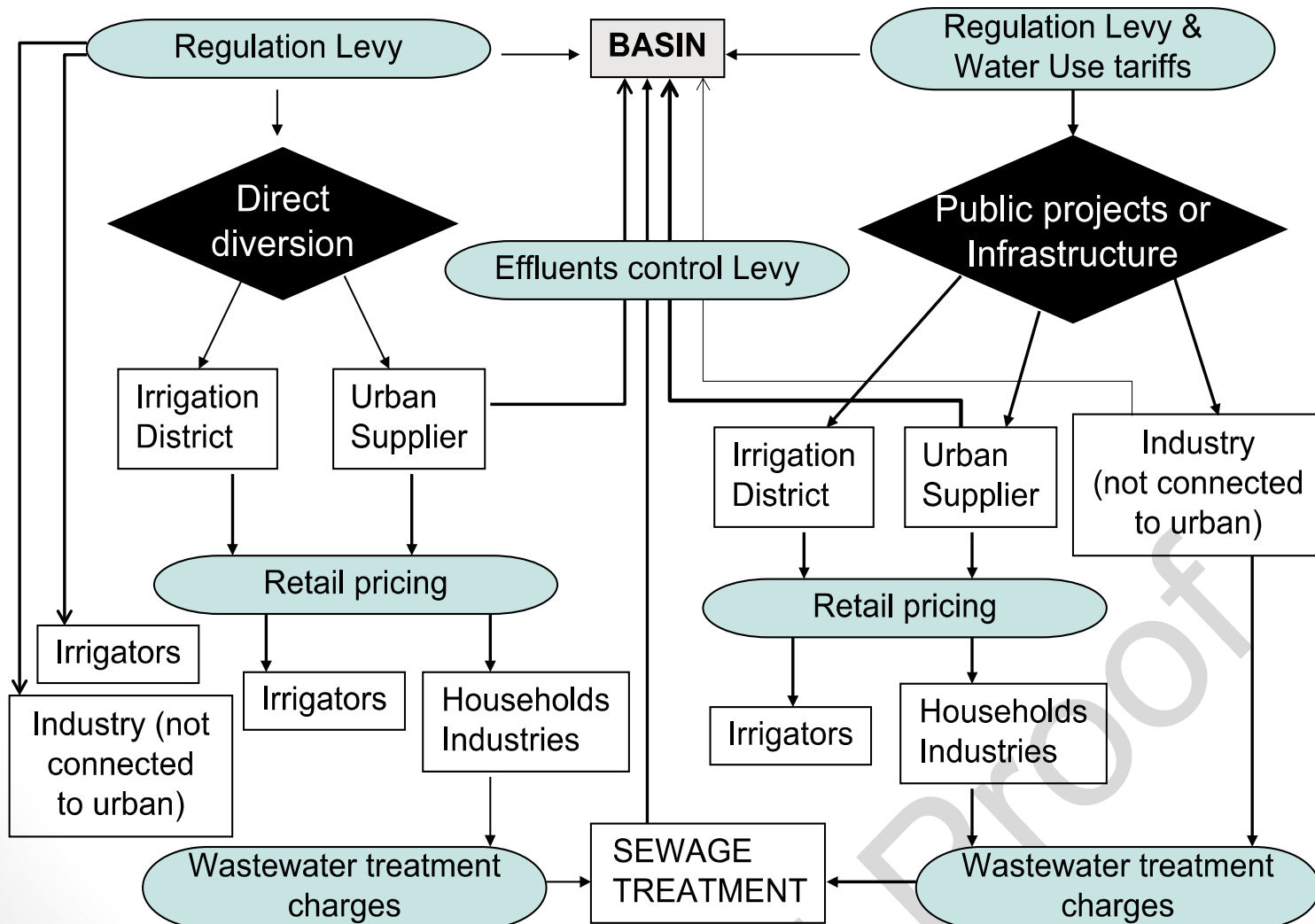


Source: Figure 11.1 in Massarutto (1915)

South Africa

- Water-scarce country, spatial variability of precip and a high level of income inequality, based largely on race
- Challenges such as how to deal with irrigation subsidies, how to address issues of equity, the possible adoption of a national charge for water, and how best to structure infrastructure-related charges
- Raw water pricing
 - Social Equity; Financial Sustainability; Economic Efficiency; Ecological Sustainability
- Afforestation water pricing
- Still need to addressing subsidies, water quality, infrastructure funding, and equity Issues
- Remaining issues
 - National vs. Hybrid Model; Introduction of Targeted Subsidies; Ecological Infrastructure; Infrastructure Construction charges; Multi-year charges

Spain



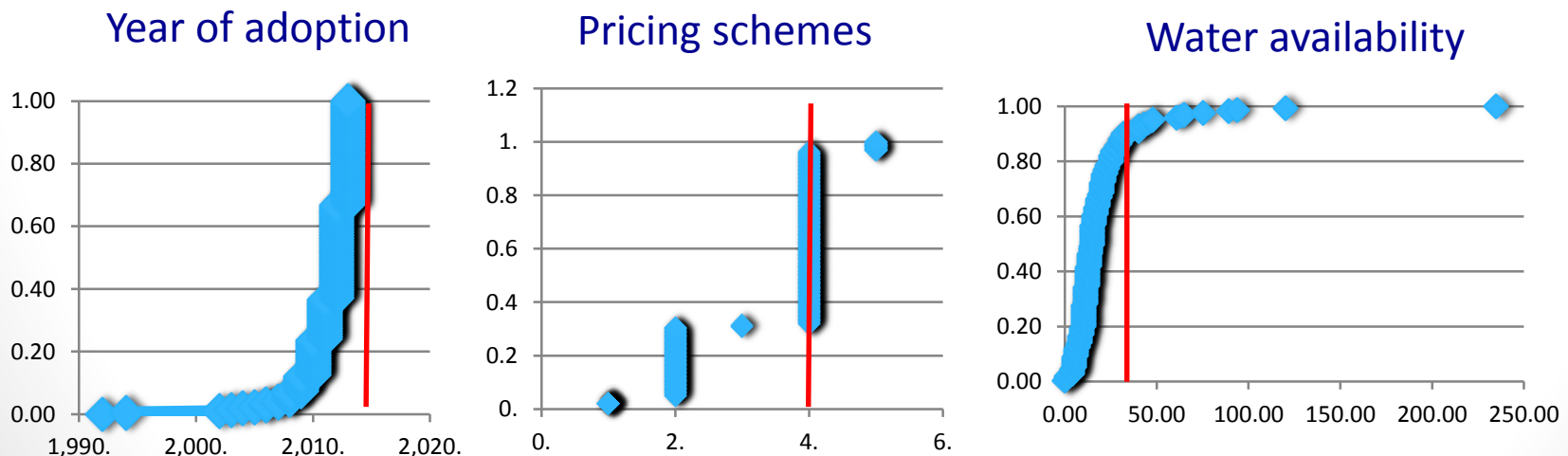
Spain

- Basin Water Authority is the regulating unit
- Four fees and tariffs paid by water users to river basin authorities, depending on the water services that they receive
 1. Users of the public hydraulic project are charged a levy to protect and improve project's conditions
 2. Urban and industrial users pay an "Effluent control levy"
 3. Users of surface water resources pay a "regulation levy"
 4. Users of specific infrastructures, such as large canals, water transfers that are not regulation works, pay a "water use tariff" aims to cover investment, operation, and maintenance costs of such infrastructure.

California:

Revising Water Pricing Schemes

- AWWA Survey of 217 water utilities in California (out of 400) between 2005 and 2013
 - Water Pricing schemes: (1) “Other”; (2) Uniform; (3) Declining; (4) Inclining; (5) Budget
 - Years of adoption: 1992-2013
 - Water availability per consumer (CCF): 5-235 (CCF=hundreds cubic feet; One CCF is equal to 748 gallons)



Source: Based on data in Dinar and Ortiz-Correa (2016)

California

- Allocation Based Rate (Budget Pricing) – ABR
 - Progressive in water use efficiency
 - Improves overall welfare compared to baseline
 - Each income group is better-off under ABR than it would be under a fiscally neutral uniform price or quantity instrument
 - Welfare under quantity restriction is slightly higher than under uniform price increase

California

- Started as a water right system- water conveyance project
 - First come first serve -use it or lose it – no trading
- No Regulation of ground water
- Slow changes triggered by droughts
- Water bank of 1991 allowed trading 250000af benefit 500-1000/AF
- CVPIA
 - Recognize environmental use as water beneficial use
 - Electronic water market
- Tiered pricing disallowed
- Low share of desalinization and recycling
- Innovative information intensive pricing-efficiency based pricing

Questions

- Importance of efficiency vs.
 - Financial sustainability
 - Equity in water pricing design
- What are the necessary conditions condition to introduce trading and water market?
- What factor should determine the features of water market?
- How to deal with water quality? Variability?
- How will new technologies affect water marketing and trading?