Economic Instruments for Integrated Water Resources Management in Arid and Semi-Arid Regions

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THE ARID CLUSTER

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First I would like to introduce the ARID Cluster book

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For more information please visit www.arid-research.net

Water Management in Arid and Semi-Arid Regions: Interdisciplinary Perspectives. Edward Elgar Publishing

The aim of this book is to present the culmination of results from the ARID Cluster of projects, which examine water scarcity and demand in arid and semi-arid regions, as well as participatory and adaptive approaches for appropriate management strategies.

Experience and lessons learned are derived from various case studies, which examine *competing water use patterns*, compare *governance structures* and study how these have evolved in response to scarcity, and analyse *structural and non-structural instruments* to address water deficiency.

The three ARID Cluster Projects contributed to this book

Aquadapt project: Co-evolutionary approach to adaptive, IWRM under changing utilisation conditions.

MEDIS project: Sustainable water use when addressing conflicting demands under varying hydrological and socio-economic conditions in Mediterranean Islands.

WaterStrategyMan project: Strategies for regulating and managing water resources and demand in water deficient regions.

What's the book all about?

Part 1: Strategies for Regulating and Managing Water Resources [WSM]

Chapter 2: The Range of Existing Circumstances in the WSM Case Studies

Chapter 3: The WaterStrategyMan Decision Support System

Chapter 4: Evaluation of Alternative Water Management Scenarios: Case Study of Ribeiras do Algarve – Portugal

Part 2: Sustainable Use of Water on Mediterranean Islands: Addressing Conflicting Demands under Varying Hydrological and Socio-Economic Conditions [MEDIS]

Chapter 5: Water Management on Mediterranean Islands: Pressures and Recommended Policy and Management Options

Chapter 6: Climate Change and Vulnerabilities to Drought on M.I.

Chapter 7: Water Use in Agriculture on M.I.: Present Situation and Future Perspective

What's the book all about?

Part 3: Economic Policies for Integrated and Sustainable Water Resources Management in Arid and Semi-Arid Regions [ARID]

Chapter 8: A Typology of Economic Instruments and Measures for Efficient Water Resources Management in Arid and Semi-Arid Regions

Chapter 9: Competition versus cooperation in groundwater extraction: A stochastic framework with heterogeneous agents

Chapter 10: A Note on the Case for Declining Long-Term Discount Rates with an Application to Flood-Defence Policy

Part 4: A co-evolutionary approach to adaptive integrated water management [Aquadapt]

Chapter 11: Socio-cultural determinants of water utlisation: A comparative analysis

Chapter 12: Some evidence of landscape change, water usage, management system and governance co-dynamics in south-eastern Spain

Main Conclusions from the ARID Cluster Book

- Examining water scarcity from a ***holistic***, ***multi-disciplinary*** perspective and getting ***stakeholders*** involved, enables the selection of feasible and effective goals for water use, protection, and conservation.
- The importance of ***demand-side management*** in addition to the more traditional supply side management of water scarcity.
- Sustainable water management in the ***agricultural sector*** deserves special attention given that it uses up more than 50 % of available water resources, and further it is the least efficient sector in water use (in some cases less than 55 percent)
- Integral to demand management is the application and use of ***economic instruments.***
- The need for effective ***monitoring and enforcement***, as well as the consistent application of monetary and civil penalties when existing regulations have been breached.
- From a social perspective, ***intra-*** and ***inter-generational equity*** with respect to water use is also of vital importance.
- ***Public awareness, educational campaigns and outreach*** are also important in order to change and correct public perceptions.

Main Conclusions from the ARID Cluster Book

Policy recommendations for the improved efficiency of water use (from the case studies):

- The adoption of new technologies for reducing consumption;
- The modification of crop patterns in agriculture to reduce water use;
- The use of indicators to identify significant inefficiencies;
- The alignment of policies in other sectors (e.g.. the elimination of subsidies to energy used for pumping groundwater for irrigation).

With regard to water conservation, re-use and recycling, the main policy recommendations:

- Rain water harvesting,
- The reduction of evapotranspiration by covering open reservoirs where feasible
- Waste water recycling and the utilisation of reclaimed and brackish water.

Economic Instruments for Integrated Water Resources Management in Arid and Semi-Arid Regions

A Typology of Economic Instruments

Key Objectives of Public Policy in Allocation of Water Resources

Efficiency: Organization of production & consumption such that all unambiguous possibilities for increasing economic well-being have been exhausted. For water, this is achieved where the marginal social benefits of water use are equated to the marginal social cost of supply, or for a given source, where the marginal social benefits of water use are equated across users.

Equity: intra and inter generational fairness of distribution of resources and impacts across society (i.e. equal access to water resources; distribution of property rights and economic effects of policy interventions, etc.)

Environment and Sustainability: Consideration of the critical nature of ecological services of water resources and intergenerational equity.

Market and Government Failures

- Water is a public good (non-rival; non-excludable)
- Externalities or missing markets

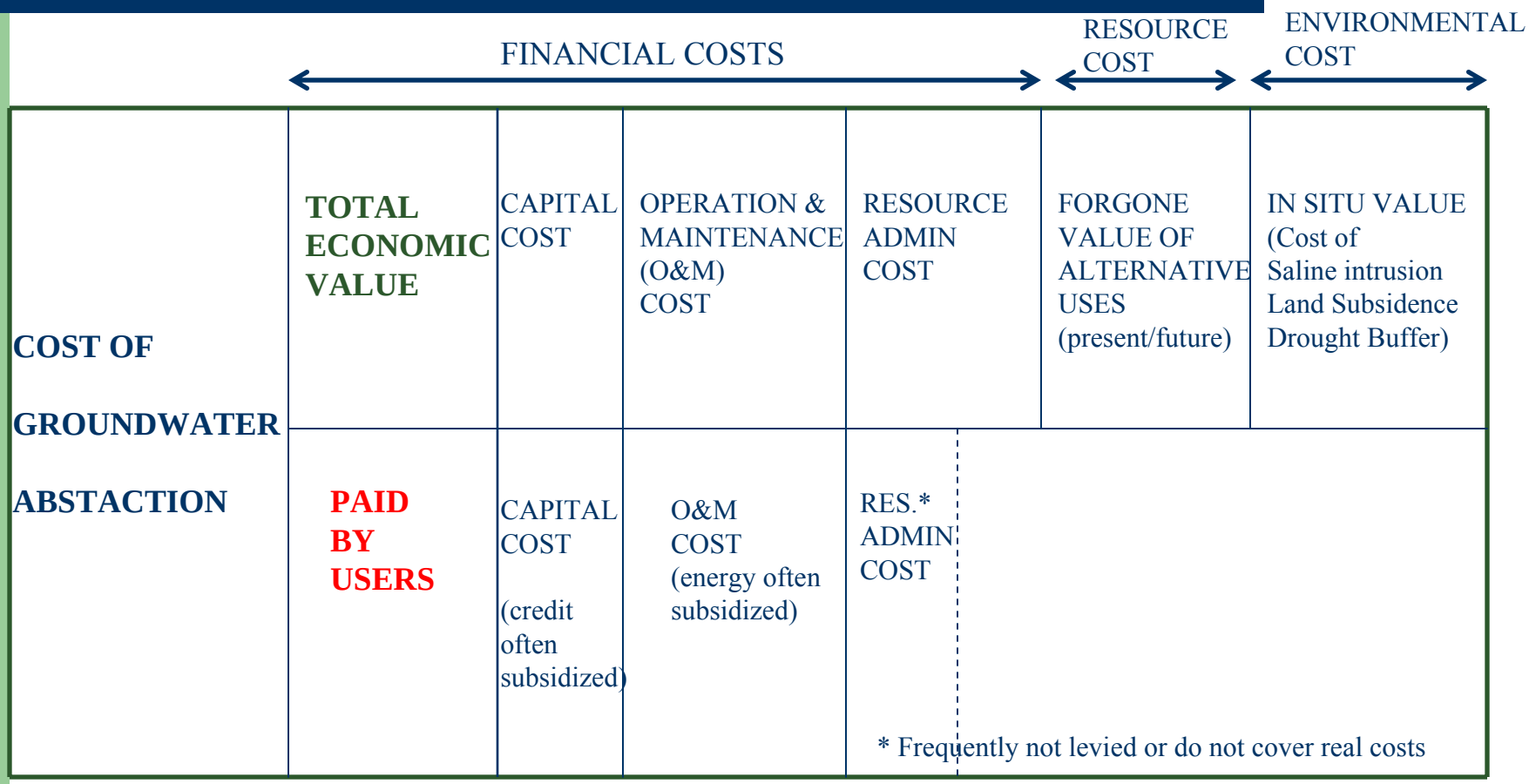
⇨ Market Failure

Government intervention is necessary. Often however governments lack institutional capacity or behave in myopic manner.

⇨ Government Failure

Together these lead to Inefficient Water Resources Allocation over time and space.

Absence of Market Prices



Resource and Environmental Costs

Resource costs: Costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. linked to the over-abstraction of groundwater).

Environmental costs: Costs of damage that water uses impose on the environment and ecosystems and those who use the environment (e.g. a reduction in the ecological quality of aquatic ecosystems; salinization and degradation of productive soils).

Source: WATECO glossary

Environmental & Resource Costs in the WFD

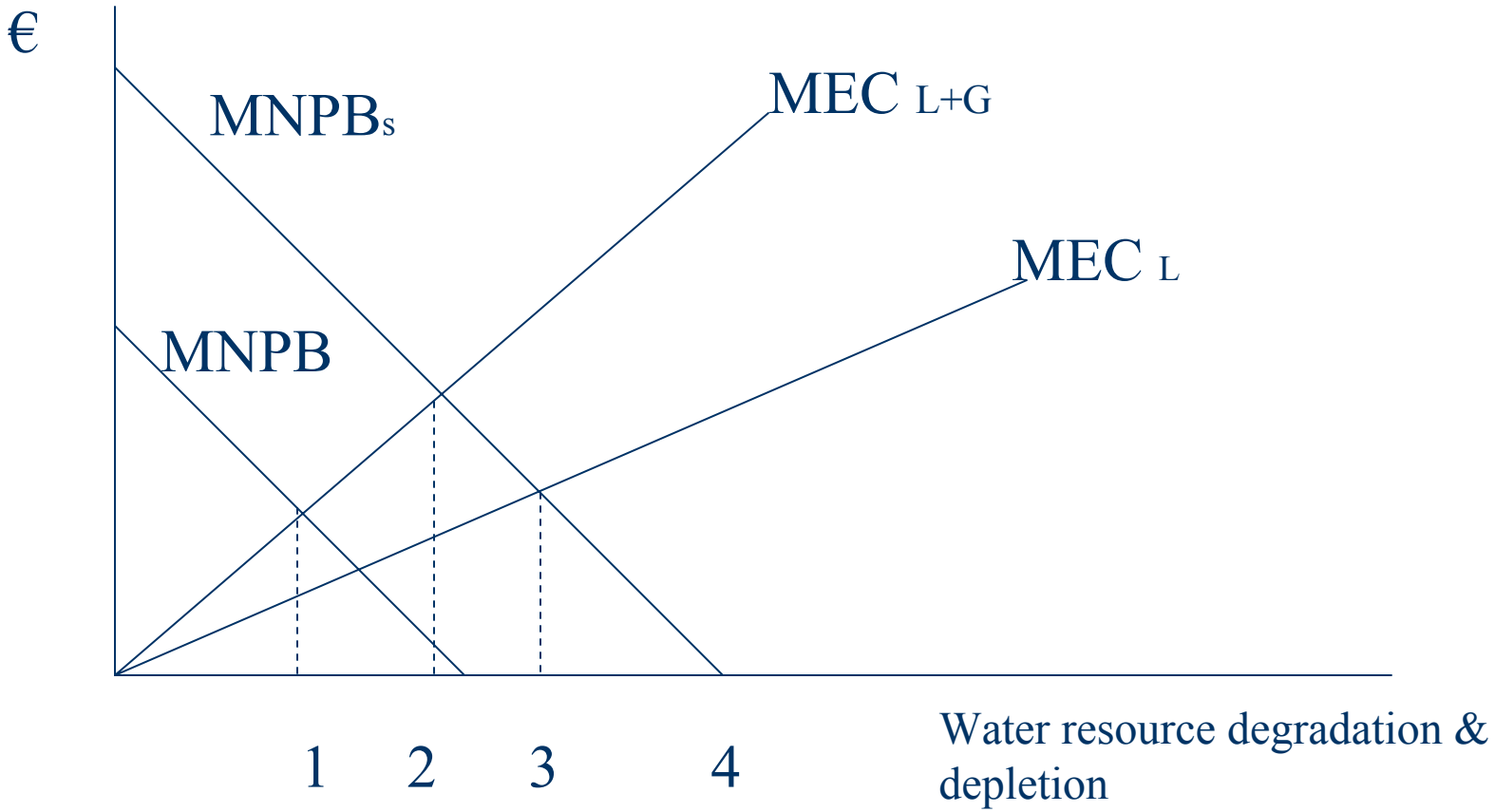
- Art. 9: E & R costs in the cost-recovery of water services

- Art. 9: Member states shall ensure by 2010 that water pricing policies provide adequate incentives for water users to use water resources efficiently, and thereby contribute to the environmental objectives of the WFD

- Annex III and Art. 11: Make judgments about the most cost-effective combination of measures with respect to water uses to be included in the programme of measures

- Art. 4: Possible economic justification for derogation (including designation of water body status).

The Optimal Price of Water:
Impacts of market and government failure



Classification of Economic Instruments		
Economic Instrument	*Advantages*	*Disadvantages*
1. Standards and Quotas	Public is familiar with these instruments	Not economically efficient
2. Water abstraction charges	Adjustment of price signals to reflect actual resource costs; encourage new technologies; flexibility; generation of revenues	Lower than optimal charges will have minimal impact on user behavior and will continue in resource over-utilization
3. Pollution charges	Same as water abstraction charges; polluter-pays principle	Same as water abstraction charges
4. Subsidies on water saving measures	Readily acceptable	Financial Constraints
5. Tradable permits	Quantity based targets that are able to attain least-cost outcome. Allows flexibility.	May entail high transaction costs
6. Voluntary agreements	Readily acceptable	Requires good co-operation between government and farmers organizations
7. Liability legislation	Assess and recover damages ex-post but can also act as prevention incentives	Require an advanced legal system; high control costs; burden of proof

WFD establishes the basic principles for sustainable water policy in Europe.

An Additional Instrument: Discounting

`Humanity has the ability to make development sustainable: to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.' **WCED, 1987**

`There is something awkward about discounting benefits that arise a century hence. For even at a modest discount rate, no investment will look worthwhile.' **The Economist (1991), March 23, p 73.**

In the decade since that comment in The Economist, the nature of the problem with long-run discounting has become clearer.

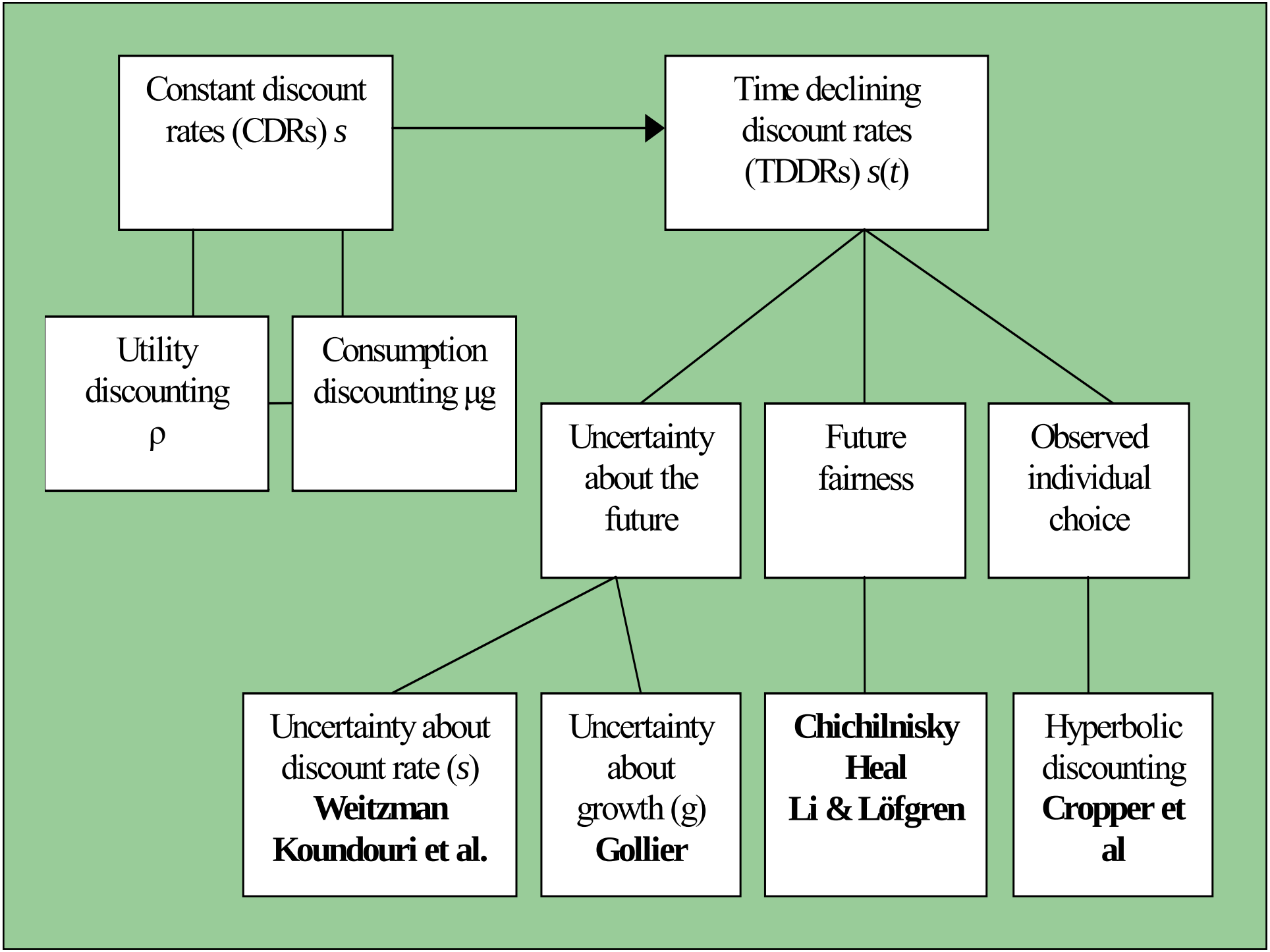
Effect of shift from flat 3.5% to the step schedule of discounting rates

Project time horizon	Potential effect on project NPV
0-30 years	Small, generally insignificant
30-100 years	Significant (± 50%)
100-200 years	Large impact (± 100%)
200-400 years	Major impact (± 150%)

The Need for Time Declining Social Discount Rate…

There are powerful reasons for choosing a declining social time preference rate. This conclusion is supported by robust recent theoretical work, which has taken several different approaches to the subject.

Although there is a paucity of empirical evidence on the pattern of that rate's decline, it may be better to use those data, which are available rather than to continue practicing discounting with non-declining rate in the long term. The data best suited the policy-makers' need were produced by Newell & Prizer (2003) and Koundouri et al (2005).


Constant discount rates (CDRs) *s*
Time declining discount rates (TDDRs) *s*(*t*)
Utility discounting ρ
Consumption discounting μg
Uncertainty about the future
Future fairness
Observed individual choice
Uncertainty about discount rate (*s*) **Weitzman Koundouri et al.**
Uncertainty about growth (g) **Gollier**
Chichilnisky Heal Li & Löfgren
Hyperbolic discounting **Cropper et al**

Suggested Step Schedule of Discount Rates

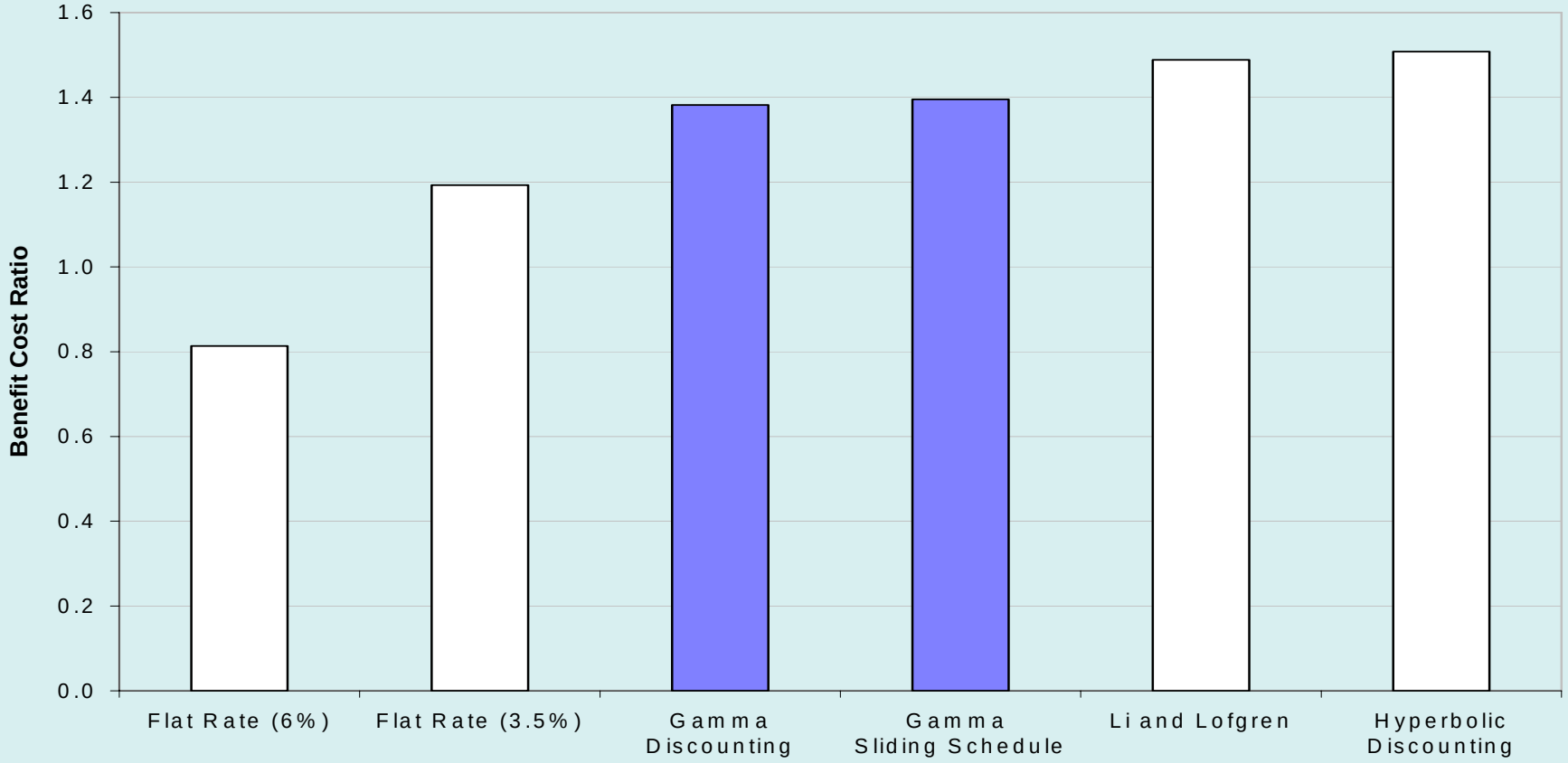
Period of Years	Discount Rate (%)
0 – 30	3.5
31 – 75	3.0
76-125	2.5
126-200	2.0
201-300	1.5
301 +	1.0

An Example: Flood Defense

DDRs affect flood defense. Over the last ten years, flood-defense investment has been characterized by annual expenditure that has been assumed to offset significant damage; i.e., a cost–benefit ratio much greater than unity.

Stochastic model by Binne, Black & Veatch designed to assess the costs and benefits of investment in a particular cell (protected area) of flood defenses for Shrewsbury for the Environment Agency.

The model determines the net benefit of investment by comparing the damage suffered in a ‘do nothing’ scenario, with damages in the case where 100-year flood defenses have been constructed. The benefits can then be compared with the costs of constructing and maintaining the defenses.



- 6%_flat : flood defence investment does not pass cost–benefit analysis
- 3.5% _flat: BCR of approximately 1.2

- flood defences are more attractive under all declining rate regimes than under either a 6% or 3.5% fixed-rate regime.

Thank you.

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