Economic Tools for WDM
- What impact in the Mediterranean?

2nd Mediterranean Water Forum

Regional Workshop on Water Demand Management in the Mediterranean

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Shaping sustainable futures

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Overview

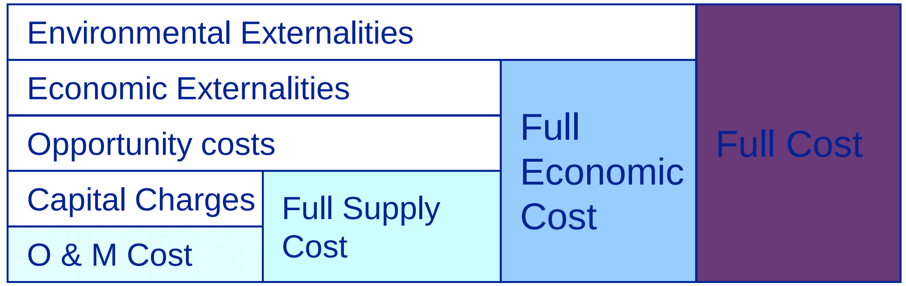
- What are we speaking about? Costs, prices and value of water
- Absence of efficient markets for water
- Different nature and purposes of water tariffs and taxes
- Water pricing for different uses: domestic, industrial, agricultural
- Prioritizing solutions: the ‘Cost curve’
- Case studies /application of economic instruments for WDM
  - Drinking water pricing with a national level perspective (Sonede, Tunisia)
  - Pricing structure for irrigation water (Jordan)
  - Subsidization of water-saving irrigation techniques (Morocco)
  - Water markets (Spain)
  - Payments for environmental services (NYC)

Costs, values, prices and tariffs of water

“Water as an economic good”

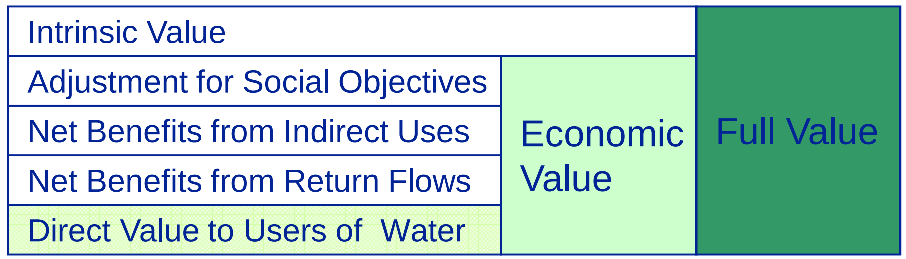
- **Cost of water**:
  - technical,
  - economical,
  - social, and
  - environmental components

  NB *Economic* externalities are assumed to be measurable, contrary to *environmental* externalities



Cf. private cost vs. social cost

- **Value of water**:
  - Direct use value: as a **final** consumption good for domestic water; consumers’ **utility**
  - Direct use value: as an **intermediary** consumption good for commercial, industrial, tourism and agricultural water; producers’ surplus (i.e. **net revenue**)
  - Indirect use value (livestock watering, micro-hydroelectricity, tourism)
  - Non use value/intrinsic value: amenity value



Cf. private value vs. social value

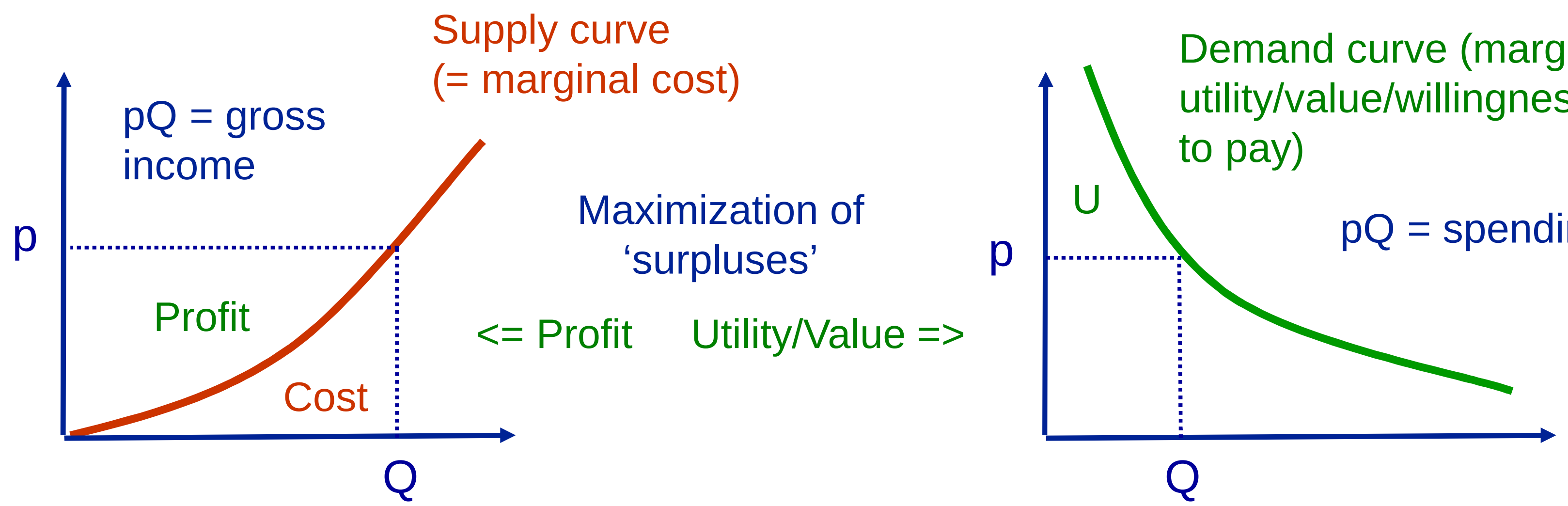
Producers' and consumers' optimization behaviors

- Marginal costs **increase** with amount of water mobilized

(the more the water mobilized, the costlier the incremental unit of water)

- Marginal returns (utility, or revenue) **decrease** with amount of water consumed or used

(the more the water consumed or used, the lesser the utility felt or revenue perceived from the incremental unit of water) – decreasing returns to scale

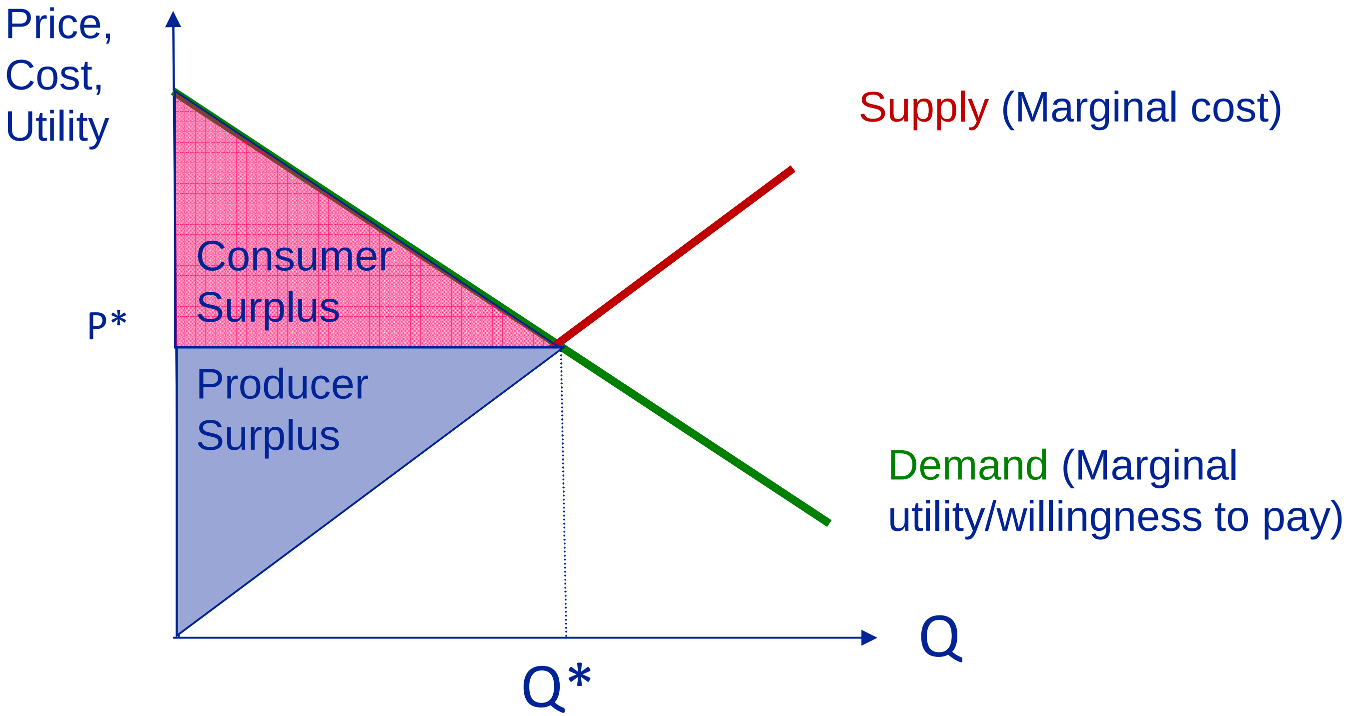


Quantities produced and consumed in response to market price signals

Aggregated surplus and market efficiency

An efficient market generates prices allowing an optimal resource allocation i.e. maximizing total surplus through ‘decentralized’ (individual) decision-making

….under certain strict conditions



Is there an efficient market for water?

Yes?
No x

Does this hold true in the real water world?

- Water generally a public *good* – *at* least, not a strictly private one
- Concept of demand not applicable to vital needs for domestic water supply and sanitation
- Market failures : presence of externalities and irreversible effects (groundwater extraction); issues of public goods funding (e.g.. watershed protection) natural monopolies (big size networks with constant returns to scale)
- Uneven repartition, scarcity, transport difficult and costly => markets, if any, would be segmented

➔ Private and social costs and benefits are not equivalent

➔ Free availability criterion not met

=> Public intervention: regulation of water allocation and use, quality standards, investment financing, public monopolies in storage, transport and distribution

➔ Not 'economic' prices but second best **administered prices** i.e. ***Tariffs***

➔ On what grounds? Efficiency/Equity/Sustainability

Tariffs, taxes and subsidies are of different nature/serve different purposes

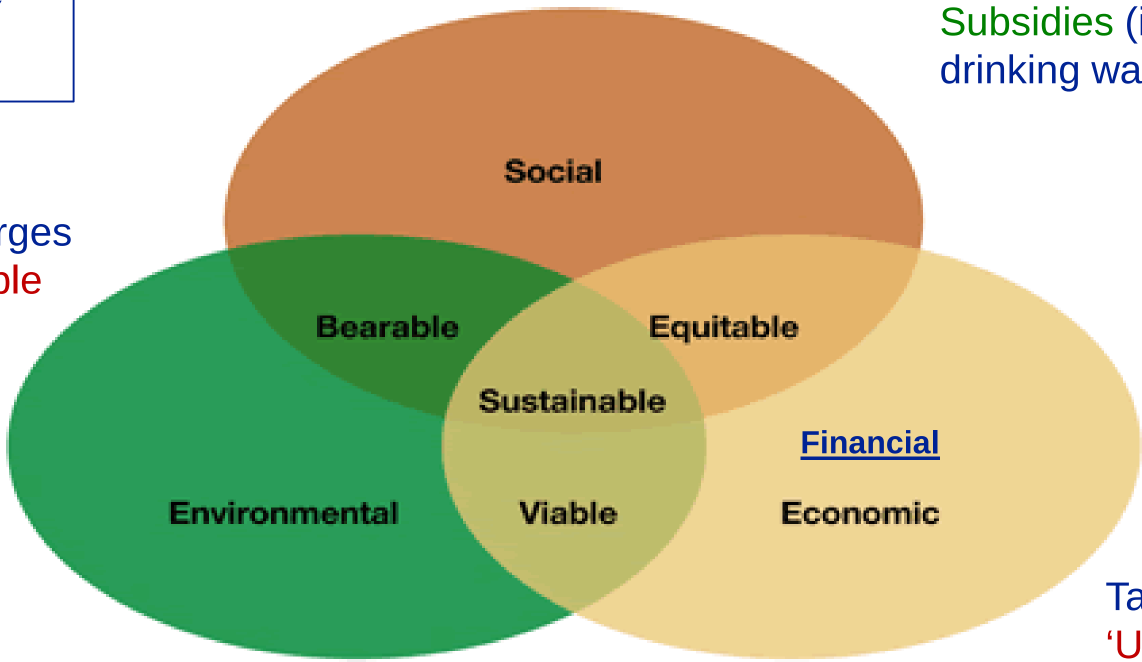
Cost recovery
Water for all
Sustainability
Others

Tariffs, users' charges
'User pays' principle

Subsidies (irrigation, drinking water)

Tariffs, users' charges
'User pays' principle

Pollution charges/taxes
'Polluter pays' principle



Royalty
Rent capture (hydropower)

Tariffs, users' charges
'User pays' principle

Subsidies to water-saving techniques

Abstraction charges/fees/taxes
Resource management, water savings, depollution

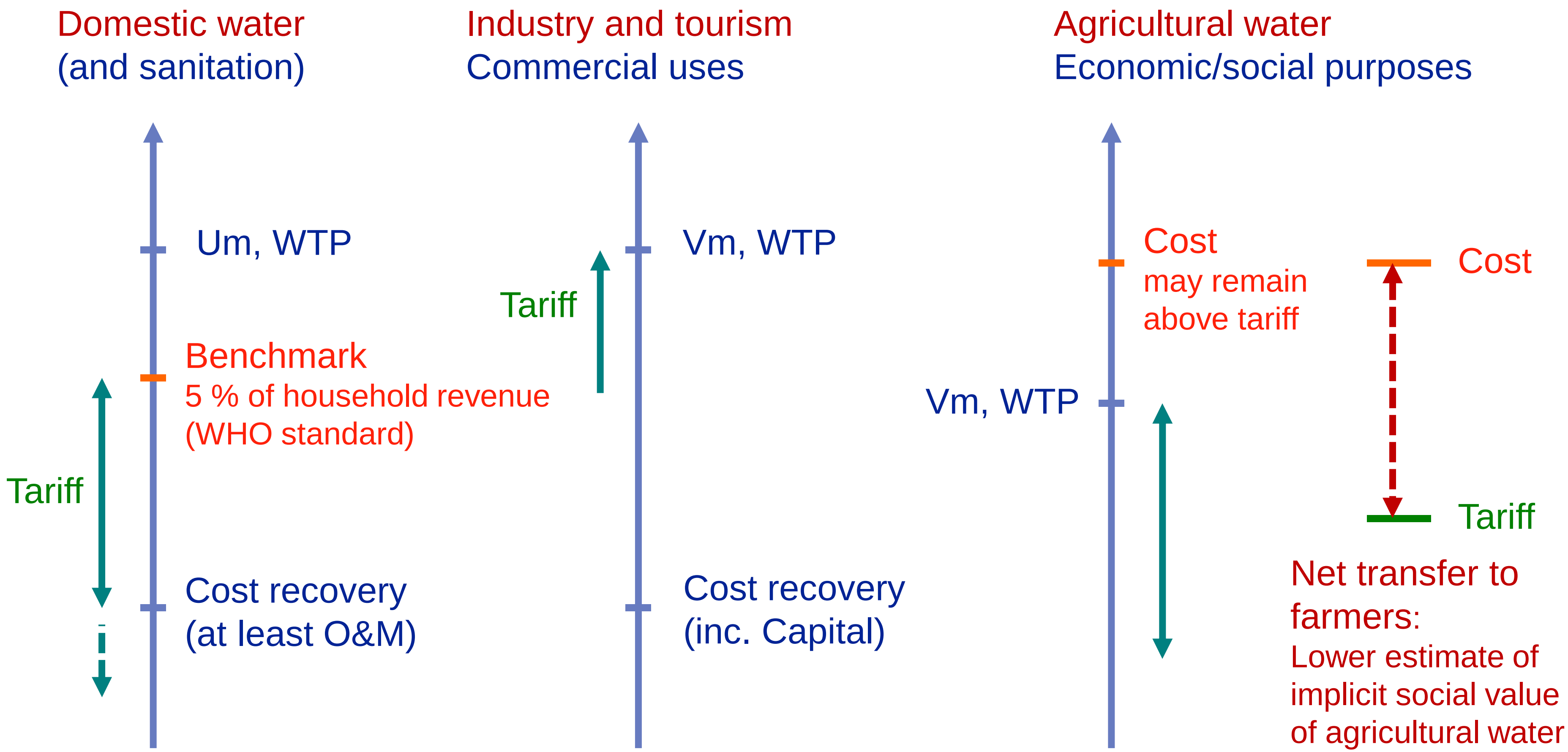
Subsidies (irrigation, drinking water)

Practical example: *"There should be two taxes on pianos: one in favor of the state, the other to the benefit of neighbors"* (Courteline, a French playwright)

Costs, values, prices and tariffs of water

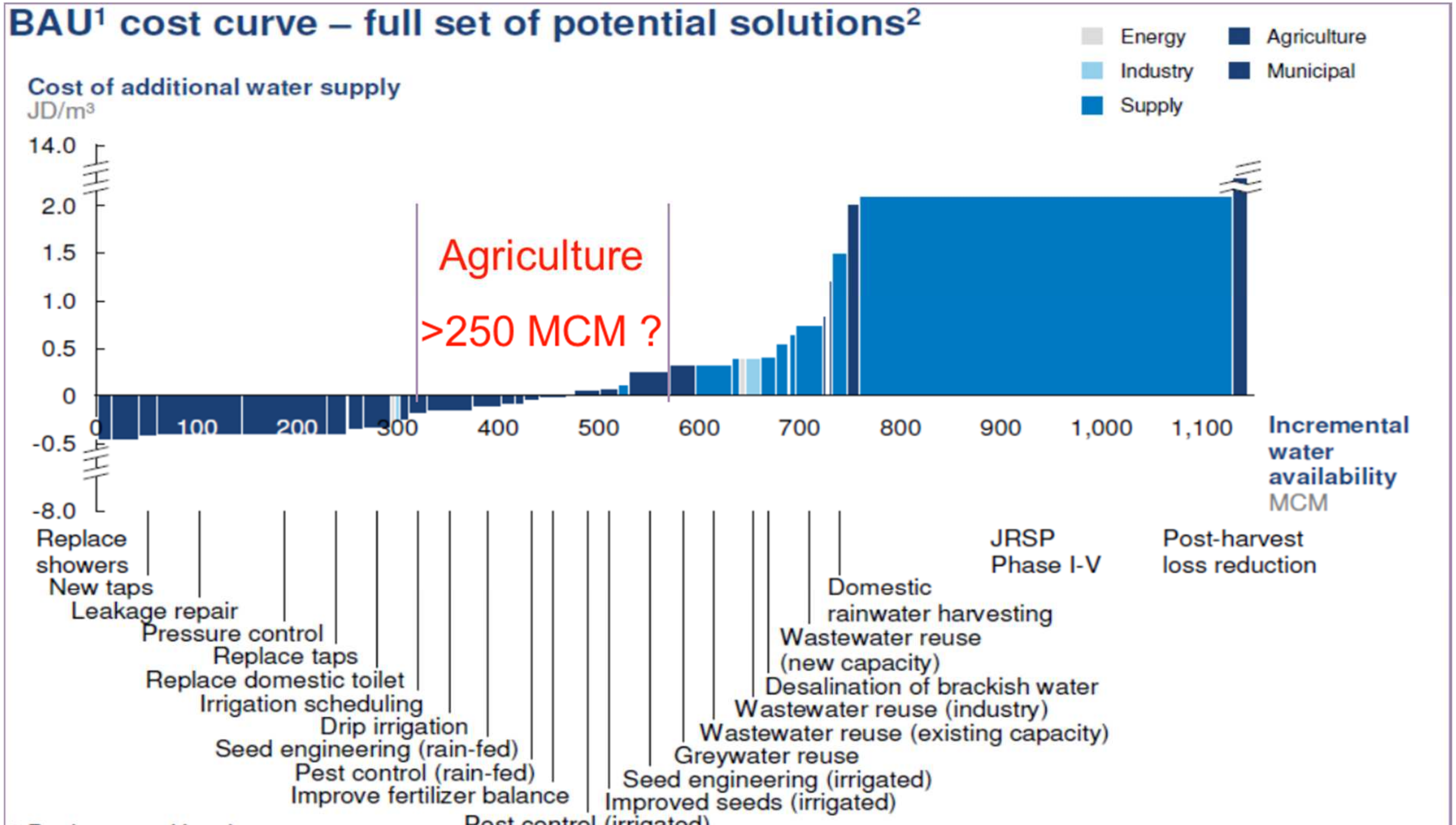
“Water pricing”, or: <u>setting an optimal tariff</u>

(which means: “as least sub-optimal as possible”)



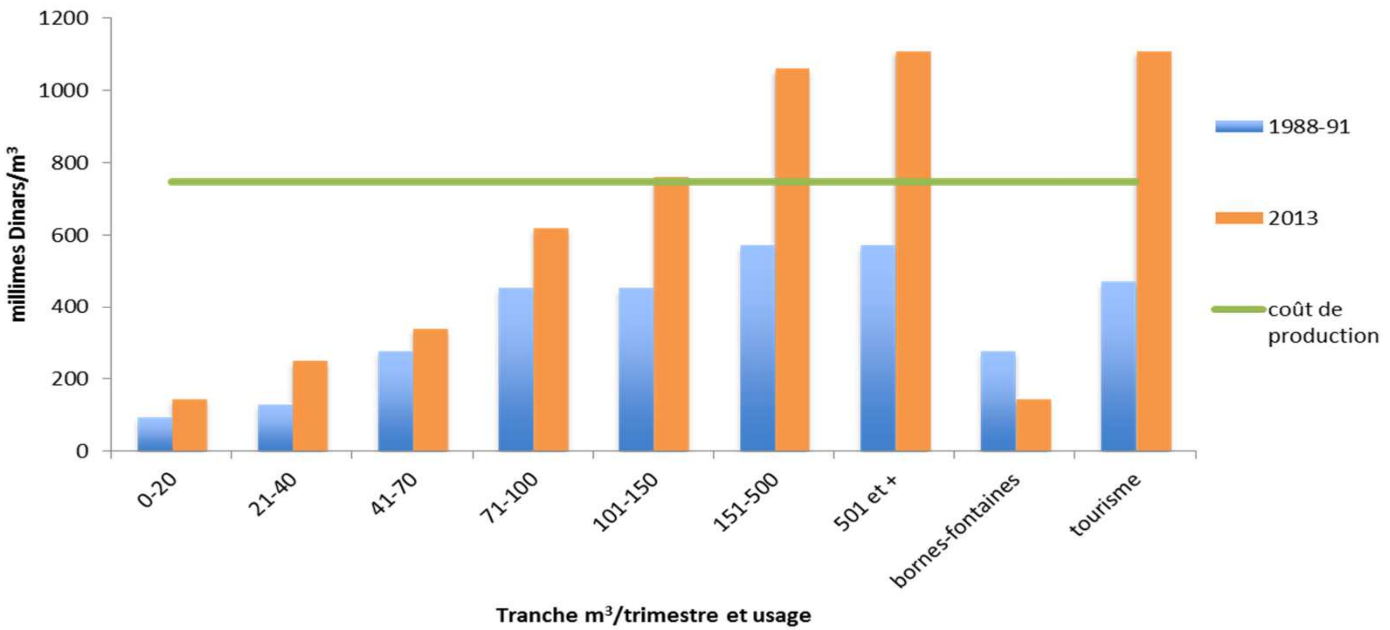
Extra charges for social or environmental purposes may be added

Economic approach to choices in water supply/mobilization/savings



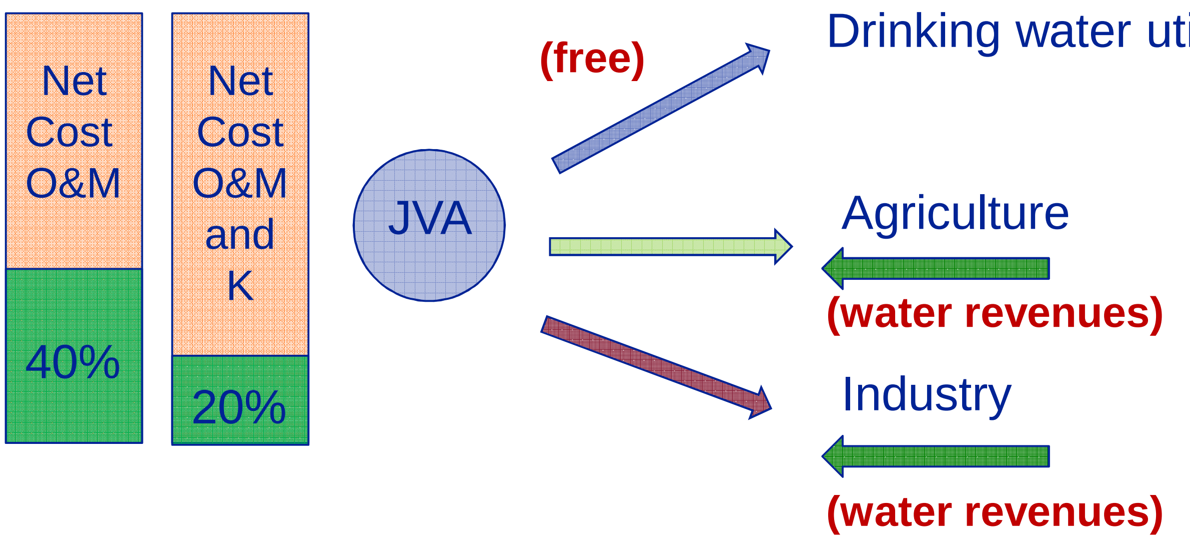
1 Business as Usual
2 Solutions with volume potential <15 MCM are not labelled

Pricing structure for drinking water (Sonede, Tunisia)



- Success: wide coverage (100% in urban areas, 93% in rural areas, out of which 50% for Sonede-operated facilities); reduced consumption as a result of raising tariffs for high consumers
- Challenges: targeting of the poor (nearly all urban domestic consumers are subsidized; fixed service fee significantly increases cost to low consumers); financial sustainability

Pricing structure for irrigation water services (Jordan Valley Authority)

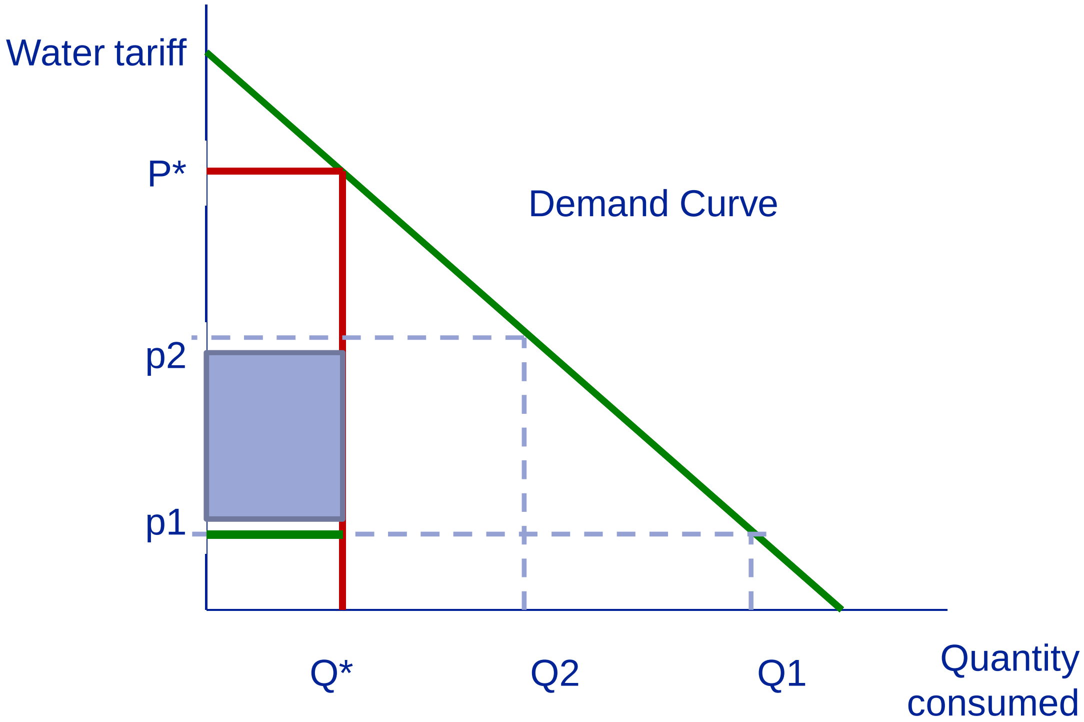


Quotas for irrigation adjust for water scarcity esp. to meet drinking water needs

- Quotas are the main instrument-subject to revision by JVA in situations of water stress
- Tariffs raised in 1997 with block tariff system
- Individual meters initially installed but rapidly deteriorated without remediation
- No shift to more water-efficient crops as originally expected
- No evidence of the role of tariff in improved water efficiency (from 57% in 1994 to 70% in 2000)
- Irrigation tariff is always only part of the story

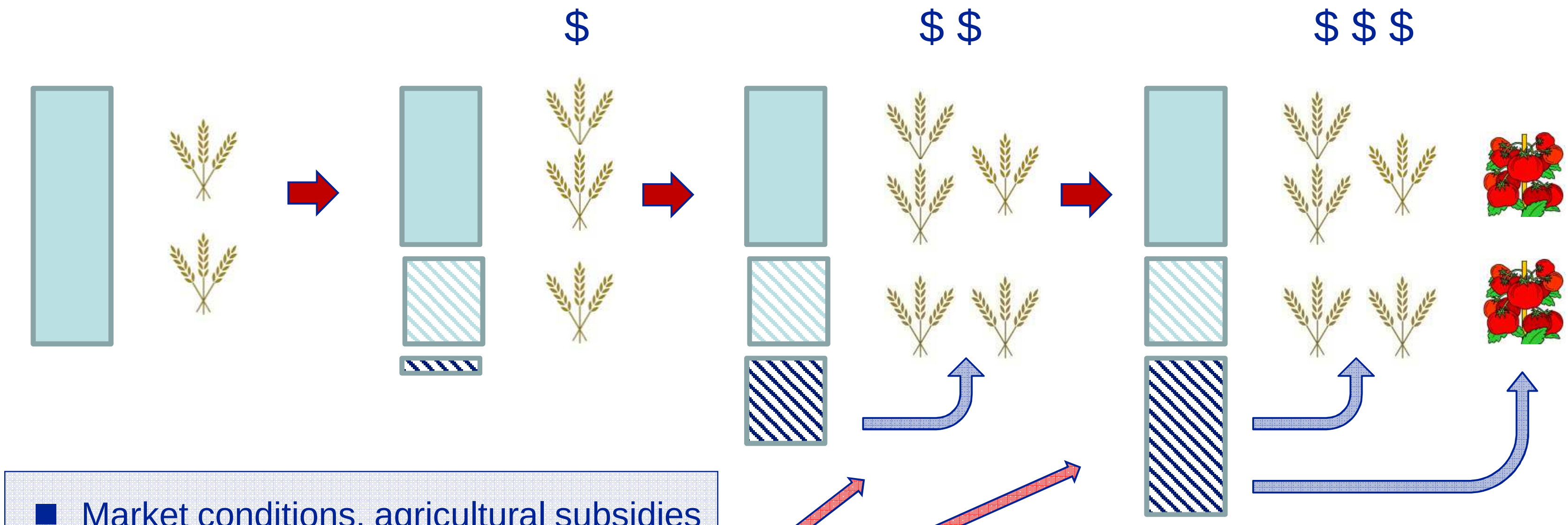
Pricing structure for irrigation water services (Jordan Valley Authority)-ctd

NB: willingness to pay for irrigation water is much higher than current rates- Some export farms desalinate their own water at a **cost up to17 times higher** than the rate applied to small producers



- Tariff is a mere tool for setting the level of an intended transfer to agriculture esp. to small farmers
- Instrument of social policy for an overall non-competitive sector – the social cost of maintaining agriculture
- Shift to higher value-added crops, if desired, should be encouraged not only by raise in tariff but also through development of opportunities and support/extension activities including risk management and specific support to small farmers

Subsidization of Water-Saving Irrigation Techniques (Morocco)



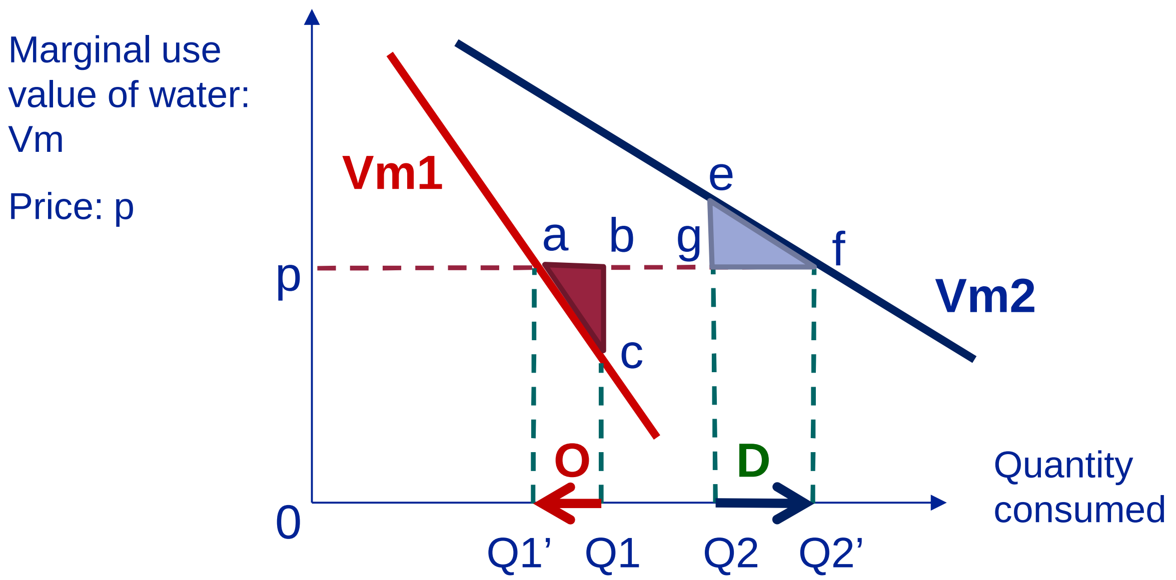
- Market conditions, agricultural subsidies
- Availability of: land; financial capital; technology and skills; (subsidized) energy and other agricultural inputs

Public spending → **Outcomes:**

- Reduced operating costs (labor, fertilizers)
- Increase in irrigated area, agricultural supply, crop yields, employment and farm revenues
- Improved water efficiency ‘more crop per drop’-if sound use of technology; better value for water

- Negative water savings, pressure on aquifers
- Big farmers main beneficiaries, windfall effects
- Resource reallocation to the detriment of downstream users: opportunity costs (economic, environmental)

Water Markets (Spain)



- Exchanges of water use rights, and associated institutions, are rooted in history; formalized in 1990s
- Today: exchanges are direct (private bilateral contracts) or intermediated: public centers – established 1999 – esp. for resource management or environmental purposes
- Within or across water basins although for similar uses, subject to approval by WBA
- (Very) limited volumes; prices higher than irrigation tariffs in large irrigation areas
- Drawbacks: concentration in ‘rich’, highly productive areas/in the hands of already well-off agents; market asymmetry in favor of sellers; still lack of flexibility for exchanges between different uses; vested interests of management bodies and agents (‘Public Choice’ theory)
- **Potential for economically efficient WDM** (savings on costly supply/storage solutions) provided clarified/secured use rights and transparent/smooth market functioning

Payment for Environmental Services
(ex. NYC and the Catskills watershed, Vittel)

Upstream agriculture conducive to resource degradation (soil, water)
- Users being within their rights -

Externalities →

Impacts of degradation on municipal water supply and quality

=>Three ways to address externalities: (theoretically equally efficient)

- Laws and regulations - No

- Environmental taxes (Polluter Payer Principle) - No

- => Direct bargaining between agents (known as "the Coase theorem")

Potential supply for conservation based on consent to receive in compensation of opportunity costs	*Internalization* ⟷ *PES*	Potential demand based on willingness to pay for opportunity costs of conservation as preferred to more costly alternatives

Conditions: 1) well defined property rights (regardless of the initial allocation of property)

2) opportunity costs < cost of alternatives so as each party can get a profit from the exchange

Different situations:

- *Transaction Costs = 0 => strict Coase conditions - OK*
- *Real world: TC > 0 => intermediation bodies (e.g.. Water Basin Agencies through subsidization of pollution reduction and resource management)*

Conclusions: contribution and potential of economic instruments for WDM

- Mixed results and achievements so far:
  - Mainly focused on contribution to cost recovery and access to drinking water
  - Better use of water for agriculture through subsidization of water saving irrigation techniques
  - Less good at saving water

- But do not throw the baby out with the bathwater

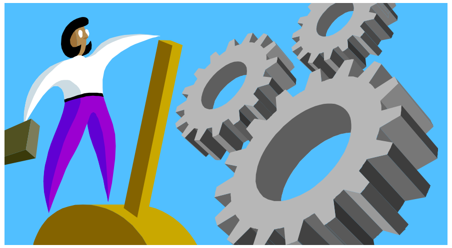
- Get basic incentives right: first, carefully review subsidies including outside water sector (energy, agriculture) – tackle ‘perverse’ subsidies with harmful effects on water resources

- Clarify purposes and objectives: you cannot have your cake and eat it

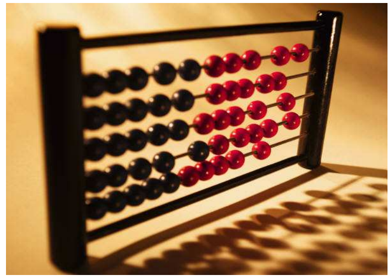
- Go further with already efficient instruments: in particular, consider raising tariffs for commercial uses of water with high marginal value, aquifer withdrawals and recreational domestic uses with high willingness (or capacity) to pay

- Think about - and test - innovative instruments: water markets, payments for environmental services, groundwater management contracts

Think outside the water box!



- Assess, monitor and evaluate



- No instrument works alone; mix instruments and have them embedded within sound sectorial and economic policies; make use of full set of public policies

- Do not feel relieved from governance issues (information, metering, control, water policing, appropriate decentralization): governance is essential

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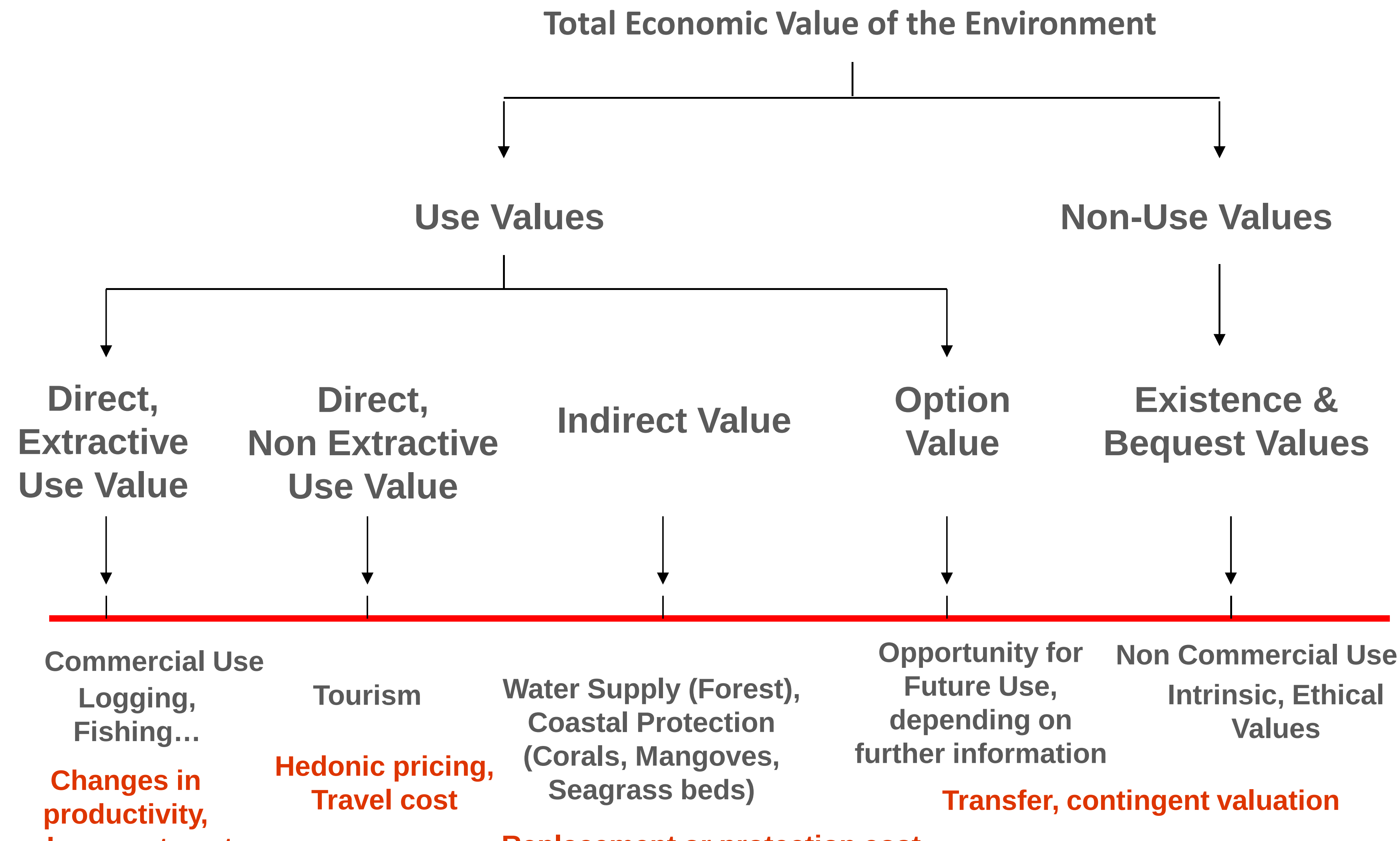
Thank you for your attention!

Shaping sustainable futures

Valuing Environmental Goods and Services

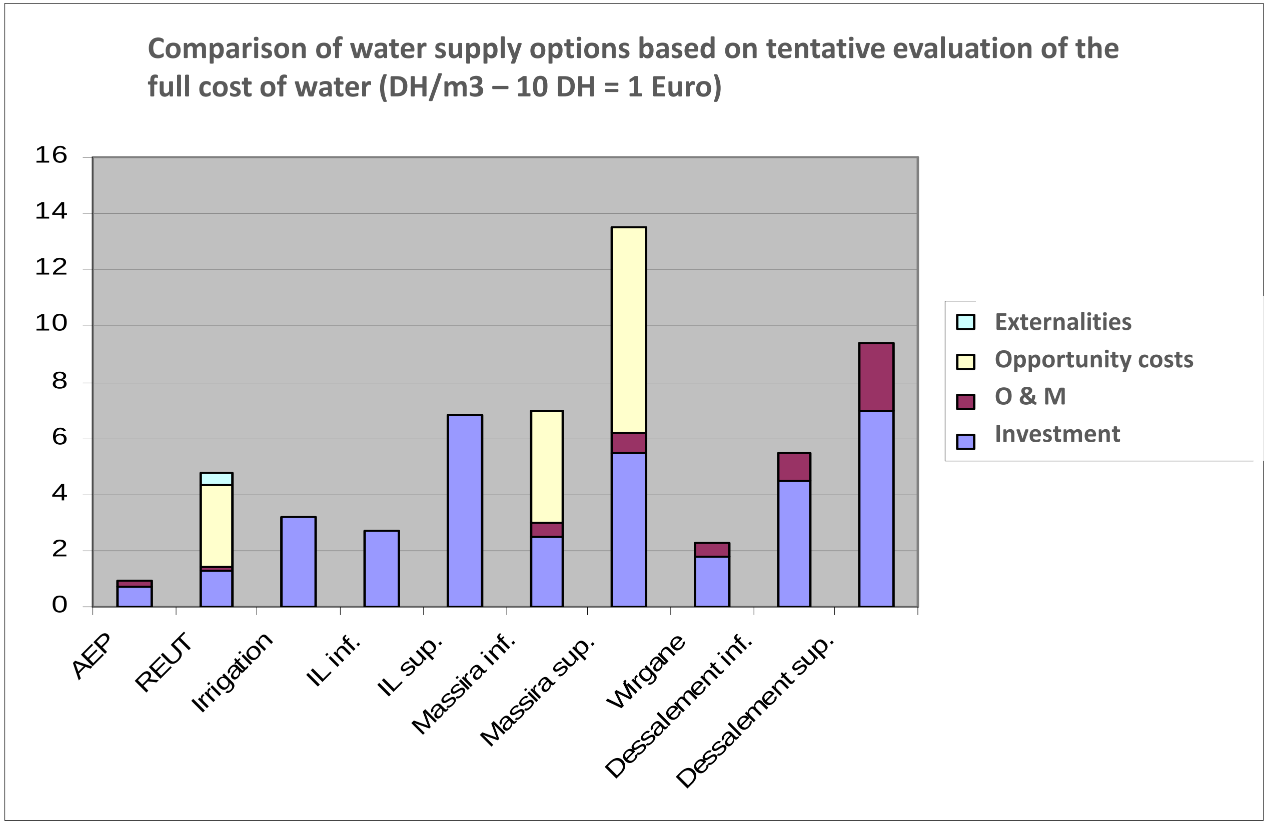


See MEA and TEEB

Taking account of opportunity cost

- Water supply options (Marrakech, Maroc) -

The mere accounting for OC makes a big difference in the ranking of water supply options (SCP et AFD, 2008)



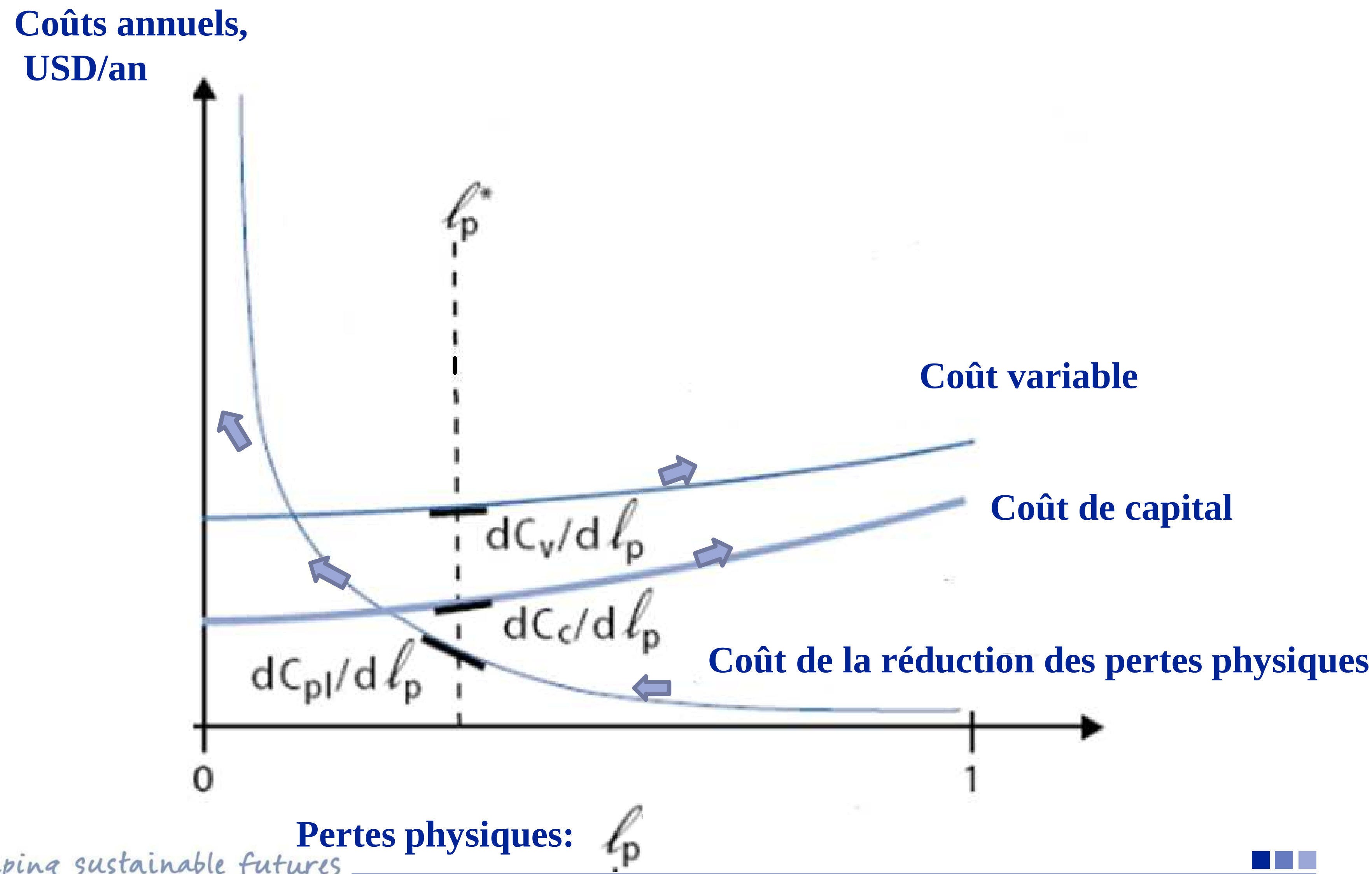
2.2 - Coût comparé des différentes solutions d'approvisionnement (3)

- Les coûts de fonctionnement ont pu être calculés ou (plus souvent) estimés - mais pas toujours
- Les coûts d'opportunité et les externalités n'ont pas pu être calculés dans toutes les options
- Or le classement des solutions d'approvisionnement sur le critère du prix de revient au m3 est extrêmement sensible à leur prise en compte
- Toutefois les solutions les plus coûteuses sont le dessalement et le transfert depuis Massira
- Les solutions les plus coût-efficaces sont des solutions de gestion de la demande : économies d'eau sur les réseaux
- L'efficacité de la REUT dépend de la prise en compte du secteur informel (coût d'éviction des irrigants utilisant les eaux brutes)

1.1 Costs, values, prices and tariffs of water

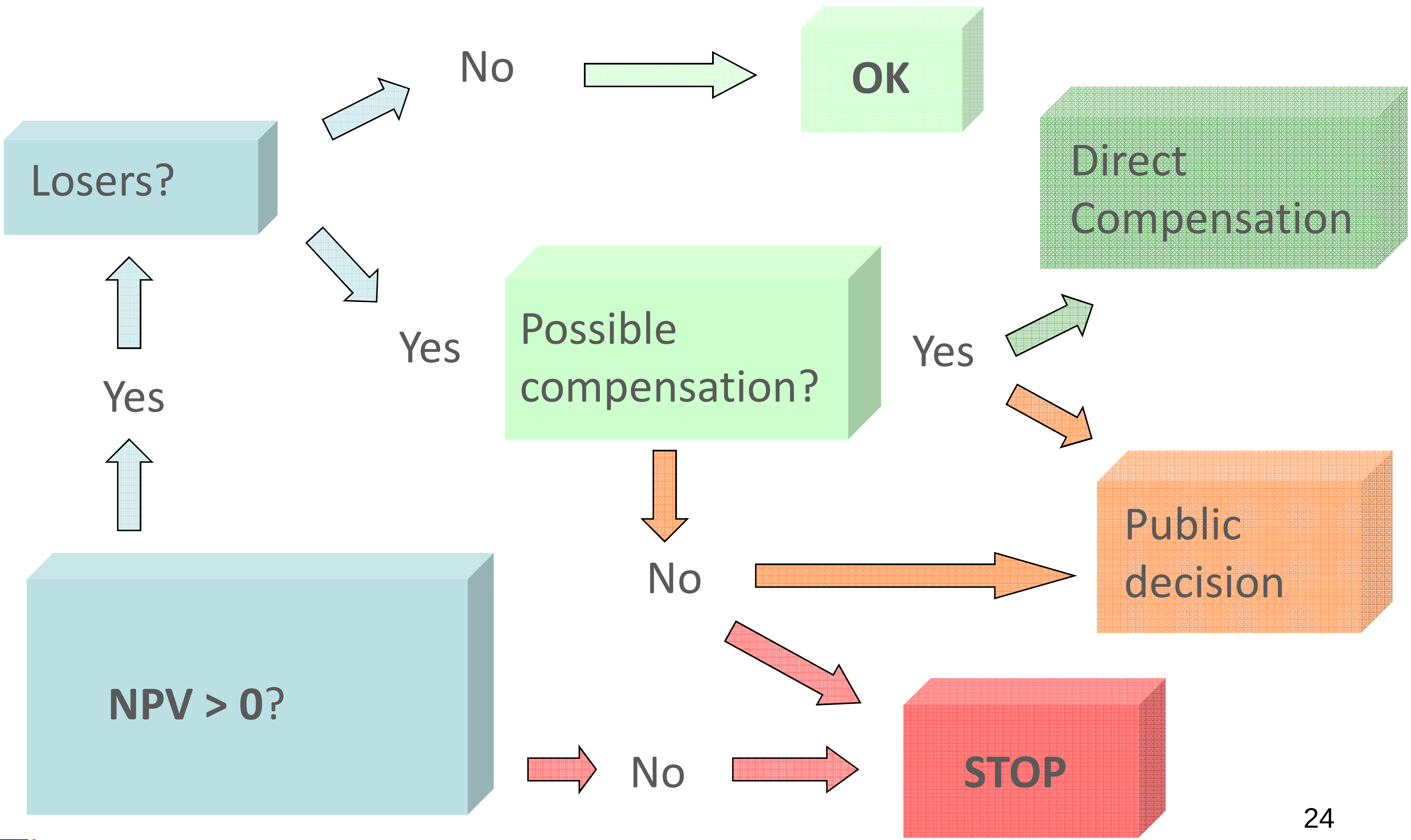
Role of the market – definition of [economic] price

- Under “perfect competition” conditions,
  - Profit- or utility maximizing behavior
  - Economic agents are ‘price takers’
  - Perfect information
  - Individual utility or revenue independent from others’ (i.e. no externalities)
  - Private and social costs and benefits are equivalent => Social welfare = summing up of individual wealth/utilities
  - No rationing of goods
  - Agents are numerous enough (no monopolies or cartels)
  - …
- … The market’s “invisible hand” sets **prices** that permanently adjust supply to demand for all goods and ensure that all quantities of marketable goods are used
- Prices are such that marginal costs equal marginal values for all uses (Q* situations)
  - Provide for efficient allocation of water amongst different sectors
  - While making use of all water available
- => Prices are produced by perfectly competitive markets - NB allocation efficiency, **not equity**



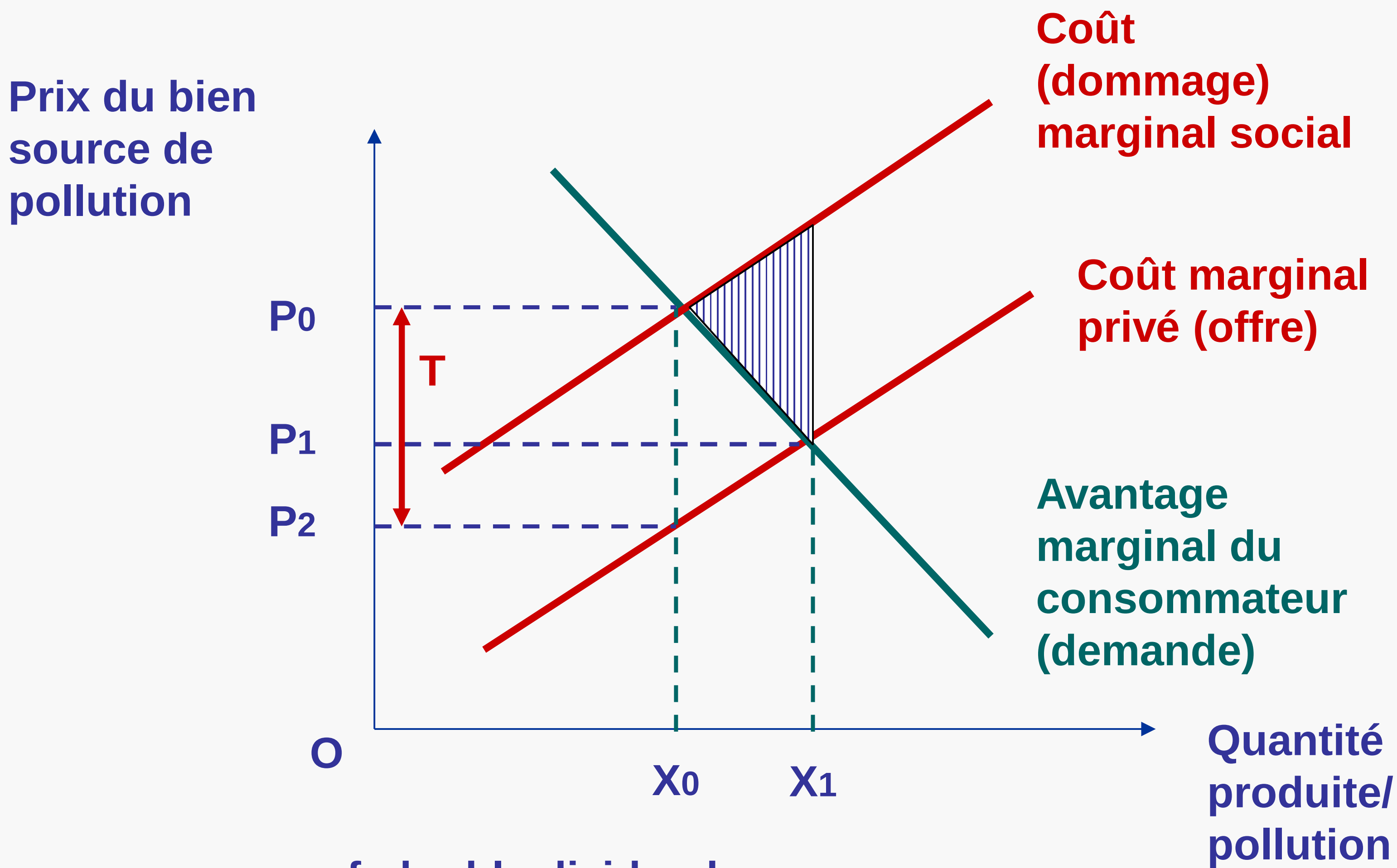
Coûts annuels,
USD/an
Coût variable
Coût de capital
Coût de la réduction des pertes physiques
ℓ_p^*
$dC_v/d\ell_p$
$dC_c/d\ell_p$
$dC_{pl}/d\ell_p$
0
1
Pertes physiques: ℓ_p

Winners and losers: efficiency vs. equity



La taxe pigouvienne (Pigou, 1920)

application du principe pollueur-payeur



- cf. double dividende
- faut-il préaffecter le produit de la taxe?

La taxe pigouvienne (Pigou, 1920)

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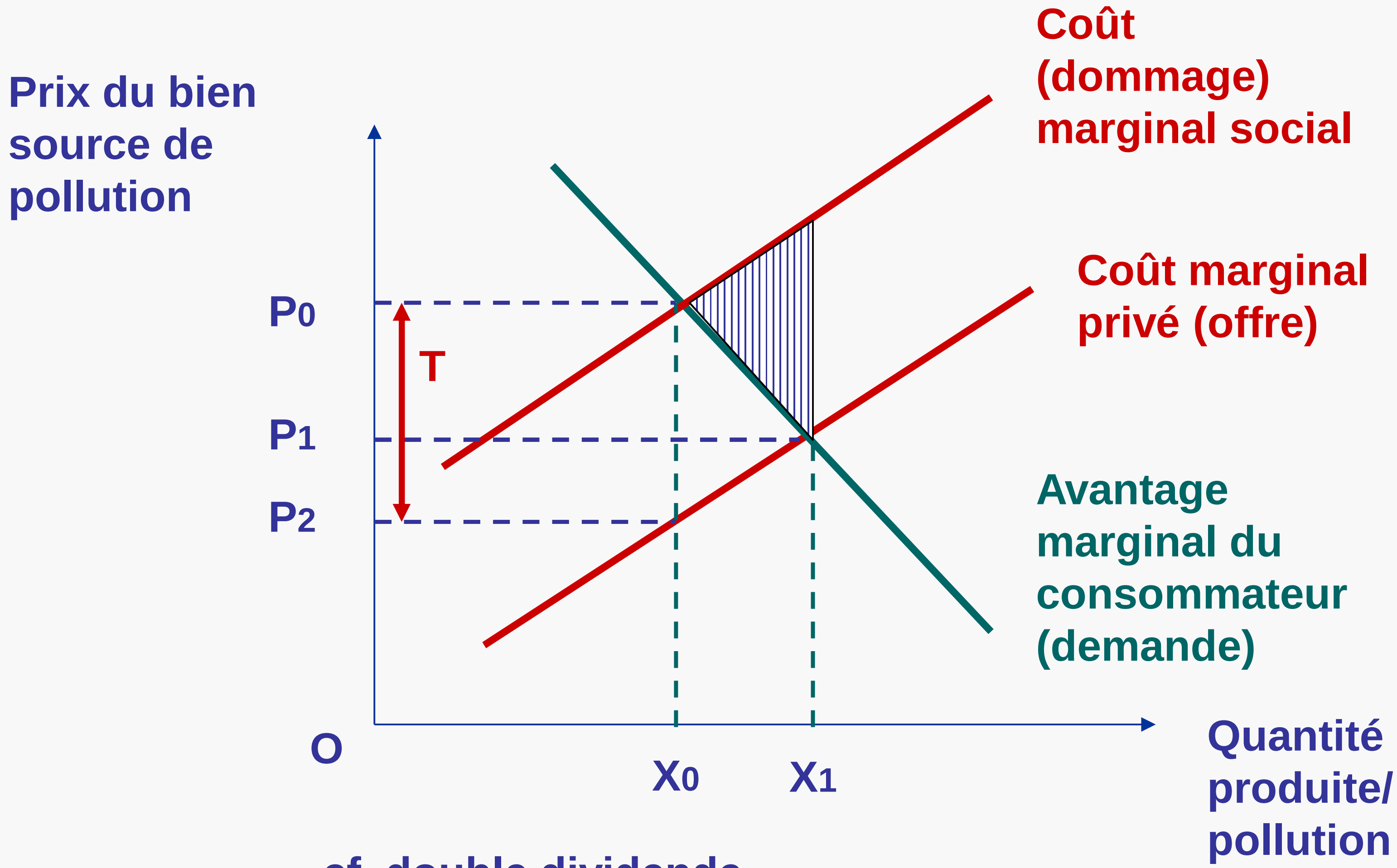
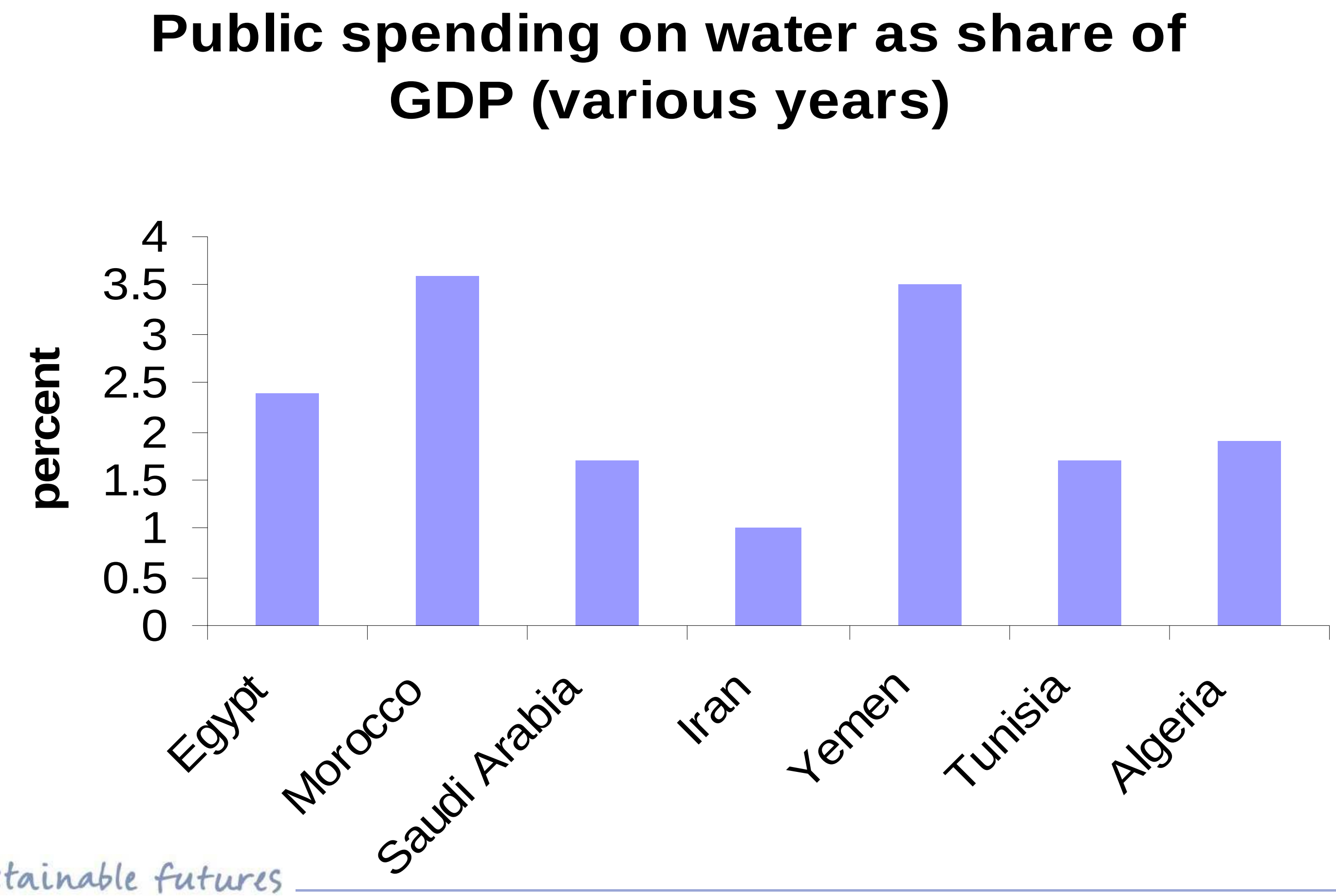


- cf. double dividende
- faut-il préaffecter le produit de la taxe?

Water receives a large share of public spending in MENA countries



2.3 - Valorisation économique de l'eau et choix d'allocation (1)

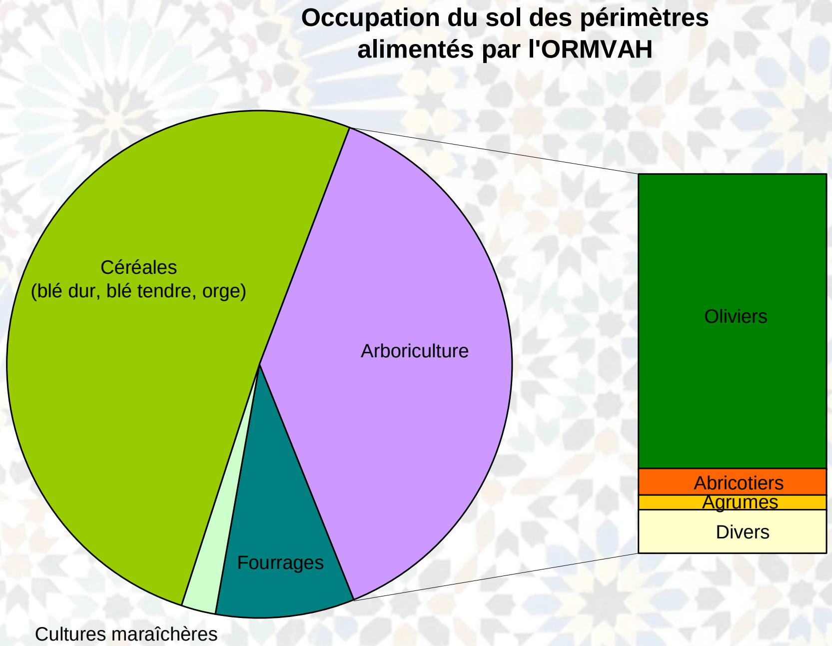
VA moyenne au m3 d'eau : agriculture vs. tourisme

Agriculture (périmètres du Haouz central) :
1,1 à 9,4 DH/m3

- le secteur privé a une bien meilleure valorisation -

Tourisme :
40 à 50 EUR/m3

=> Rapport de 1 à 100



2.3 - Valorisation économique de l'eau et choix d'allocation (2)

Intérêt et limites de l'approche basée sur la VA / m3

- Raisonnement en VA moyenne au lieu de VA marginale
- Problématiques tourisme et agriculture non homogènes
- Une question post moderne avec confrontation inégale de deux activités
- Raisonnement en creux : qu'est-ce que cet indicateur VA/m3 ne dit pas ?
  - Agriculture : valeurs indirectes (élevage, transformation des produits…), recharge des nappes, drainage, valeur sociale (emploi), aménités environnementales (avec impact sur le tourisme)
  - Tourisme : hausse des prix et effets d'éviction pour les consommateurs locaux, émissions de GES

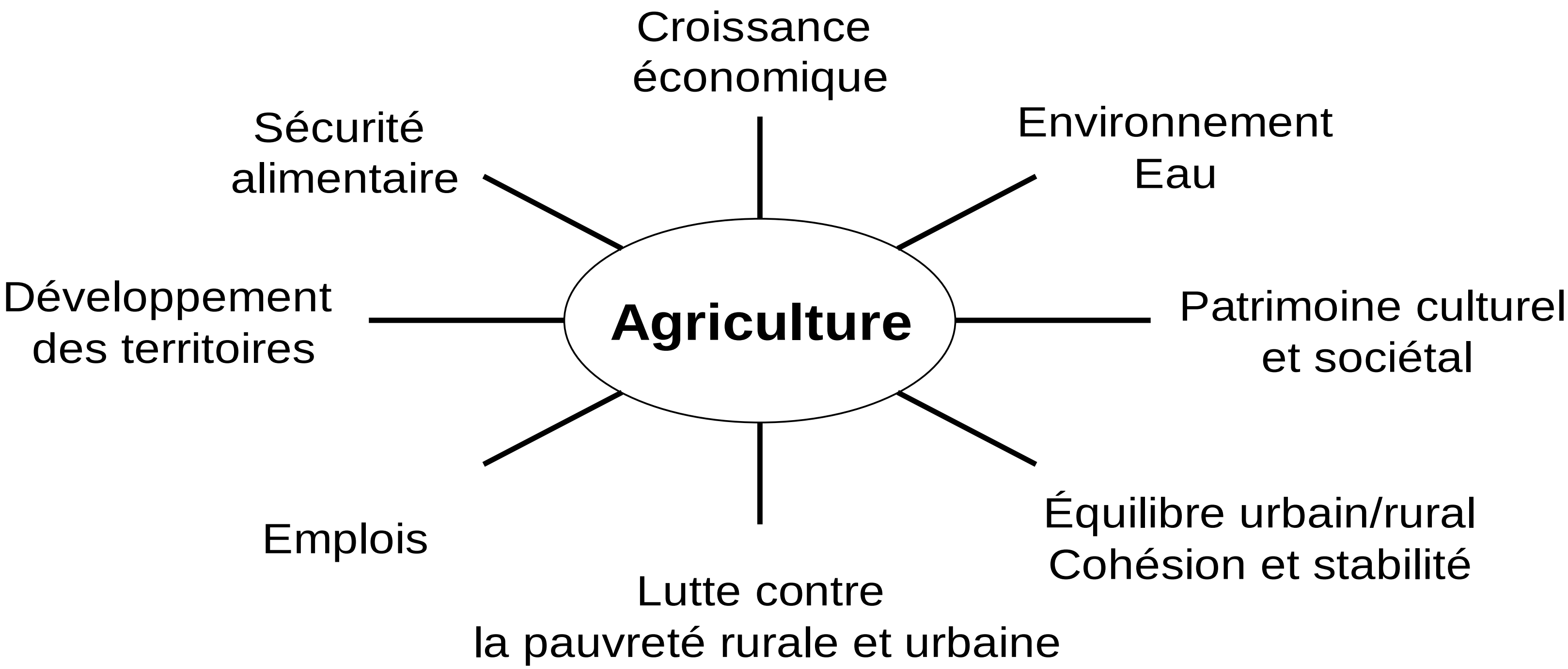
2.3 - Valorisation économique de l'eau et choix d'allocation (3)

Intérêt et limites de l'approche basée sur la VA / m3

- Quel scénario souhaite-t-on et aussi quel scénario veut-on éviter ? (développement à deux vitesses…) => prise en compte du coût humain, social et environnemental de la perte d'emploi en agriculture
- Modèle plus complet avec cinq capitaux : K N P F H S ?
- Reformulation :
  - Distinguer une agriculture compétitive et une agriculture « sociale » ?
  - Pour l'agriculture : productivité mais aussi rémunération des services sociaux et environnementaux : multifonctionnalité
  - Intégration du tourisme, de l'artisanat et de l'agriculture : produits, services ? (ex. argane)
- Problématique de développement territorial durable, équitable et maîtrisé

2.3 - Valorisation économique de l'eau et choix d'allocation (4)

Quelle agriculture pour le Maroc ?



Prospective 2030, CGP, Royaume du Maroc

Assessing Value of Water in different uses

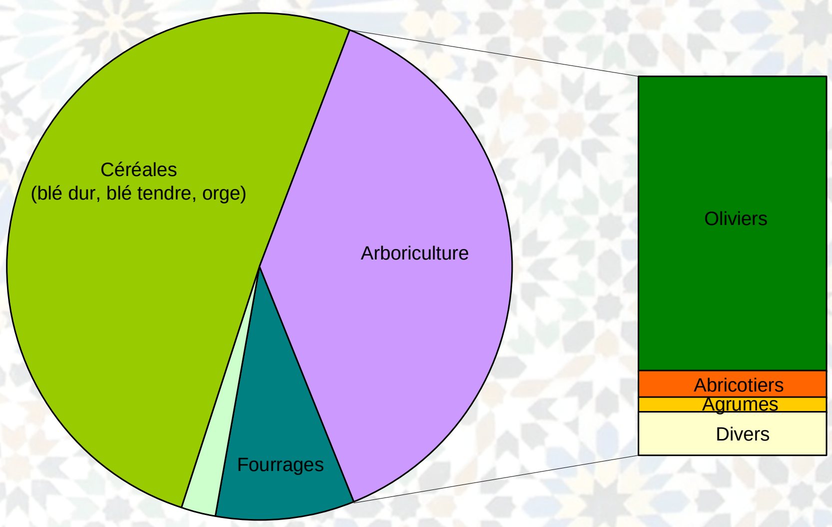
Average value added by m3: agriculture vs. tourism

Agriculture (Central Haouz irrigated areas):
1,1 to 9,4 DH/m3

- Private sector achieves a far better value for water -

Tourism:
40 to 50 EUR/m3

=> Ratio of 1 to 100



Water valuation and allocation choices

Interest and limits of the VA/m3 approach

- Average VA (reflects current situation) instead of marginal VA (appropriate criterion for allocation choice) was used for comparison
- Tourism and (esp. smallholder) agriculture issues are not homogenous in nature-comparison is imbalanced, “unfair” from a social viewpoint
- Reverse thinking: what does the VA/m3 indicator not say?
  - Agriculture: indirect values (livestock rearing, processing of agricultural products…), groundwater recharge, drainage, social value (employment), environmental amenities with impact on tourism
  - Tourism: price rise => loss in purchasing power for local consumers, GHG emissions

Public Policies:Typical Intervention Effects

Actions:

- Material: infrastructure investments, input supply…
- Institutional: laws, regulations, contracts, taxes/incentives…
- Informative: awareness, training

Result in changes (effects) in:

- Physical environment, production and consumption functions
- Rules of the game
- Behavior

And further changes (impacts) in:

- Production and consumption patterns
- Distribution of goods and services, revenues, rights
- Stakeholder interactions

From Walliser B.